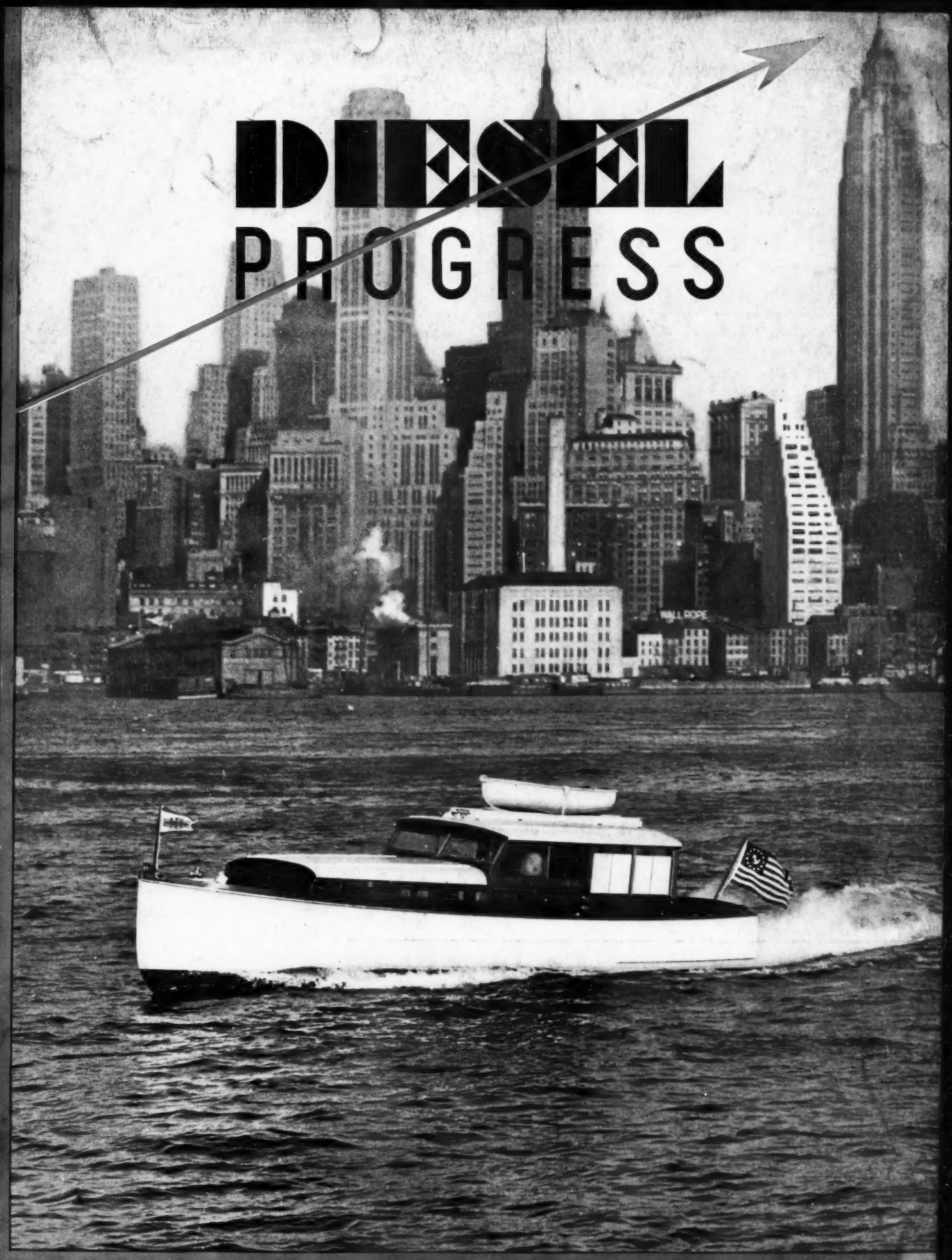
DIESEL PROGRESS

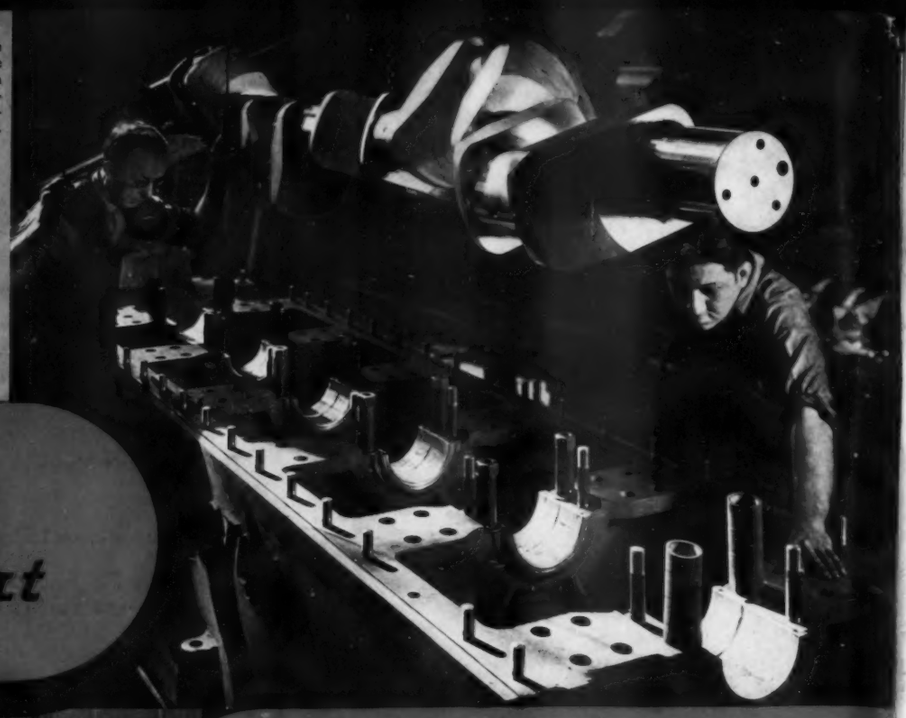
IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



JANUARY, 1936 CIRCULATION OF THIS ISSUE—IN EXCESS OF 10,000 COPIES 25c

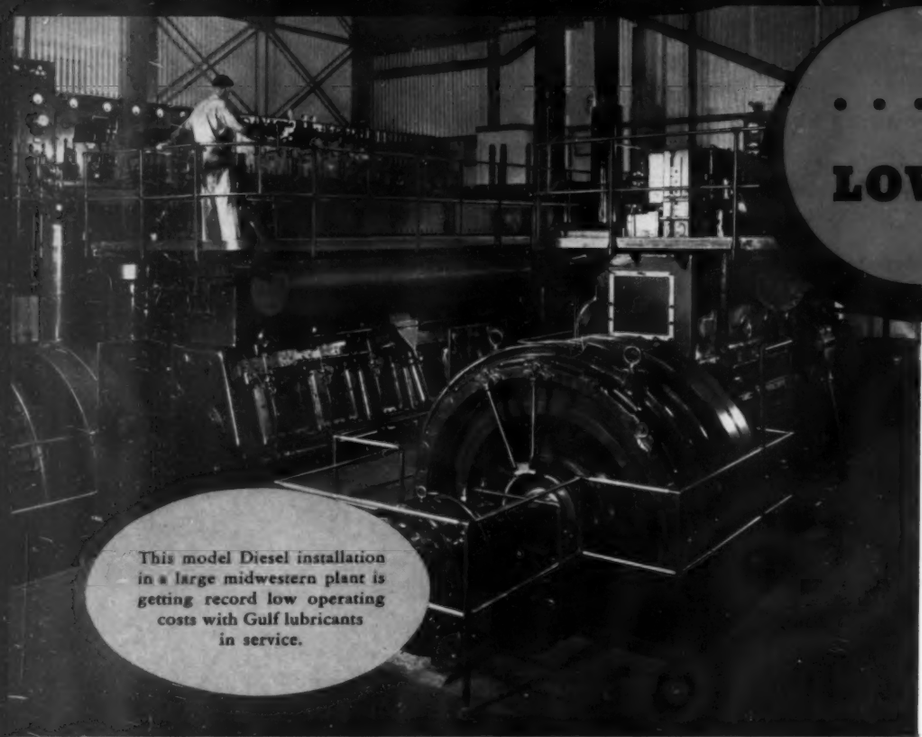
This mighty crankshaft will turn in bearings which must have complete protection against friction to assure a minimum of wear and replacement expense. As a safety factor, use Gulf lubricants from the start for your Diesels.

GULF INDUSTRIAL LUBRICATION



USE GULF PARVIS OIL *from the start*

. . . AND GET RECORD LOW OPERATING COSTS



This model Diesel installation in a large midwestern plant is getting record low operating costs with Gulf lubricants in service.

"We have made the best record in our section of the country for low plant operating costs—and Gulf lubricants have been an important factor in this achievement!"—that is the statement of a leading Diesel power plant operator in a southeastern state.

Many similar reports have come from other users. Gulf lubricants, when used according to the recommendations of an experienced Gulf engineer, invariably increase the efficiency of Diesel equipment.

America's Diesel engine builders, more than 50 strong, have approved Gulf Diesel lubricants. And many years of tests in service have proved the quality of these products. Why not discuss with a Gulf engineer just what steps can be taken to improve the lubrication and operation of your equipment?

4 REASONS... WHY GULF QUALITY LUBRICANTS Will Cut Your Operating Costs

1 Gulf highest quality lubricants are refined by the ALCHLOR process. This famous process, patented and owned exclusively by Gulf, is the most thorough and effective method for removing the impurities and unsaturated hydrocarbons from lubricating oil.

2 Because of the highly selective treatment given to Gulf high quality lubricants, they have highest resistance to acidity, oxidation and gum-forming tendencies. Hence, they are more resistant to deteriorating influences.

3 When you use Gulf lubricants you receive the service of a trained lubrication engineer. He knows how to make machinery run more efficiently and can be of real assistance to you in solving your lubrication problems.

4 The Gulf engineer aims to reduce your maintenance and operating costs through improved lubrication practice. He strives to make savings in your *real* lubrication costs—as well as to reduce the total gallonage of lubricants consumed in your plant.

Gulf Refining Company
PITTSBURGH, PA.

District Sales Offices: Boston · New York · Philadelphia · Atlanta · New Orleans · Houston · Pittsburgh · Louisville · Toledo

DIESEL PROGRESS for January, 1936. Volume II, No. 1. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex. W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Pan American countries $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U.S.A., 50 cents for all other countries.

IT gives us a great deal of quiet satisfaction to announce the third contract within a year for the United States Navy. We have been entrusted with the commission to build two 850 KW. Diesel generator sets for the new airplane carrier. Under construction in the Hamilton Engine Shops is the propelling machinery for one U.S. submarine placed with us about a year ago; the propelling machinery for three U.S. submarines placed with us last October, and now this order for two big Diesel generating sets.

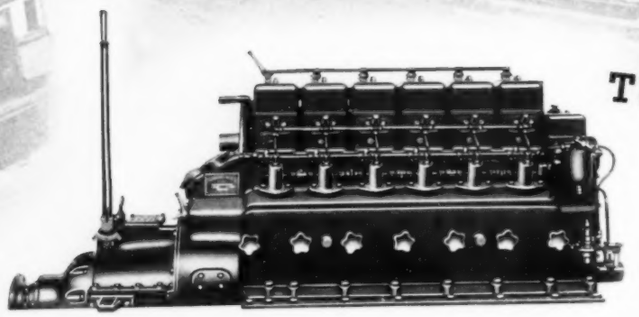
HAMILTON - M. A. N.

The Hooven, Owens, Rentschler Co.

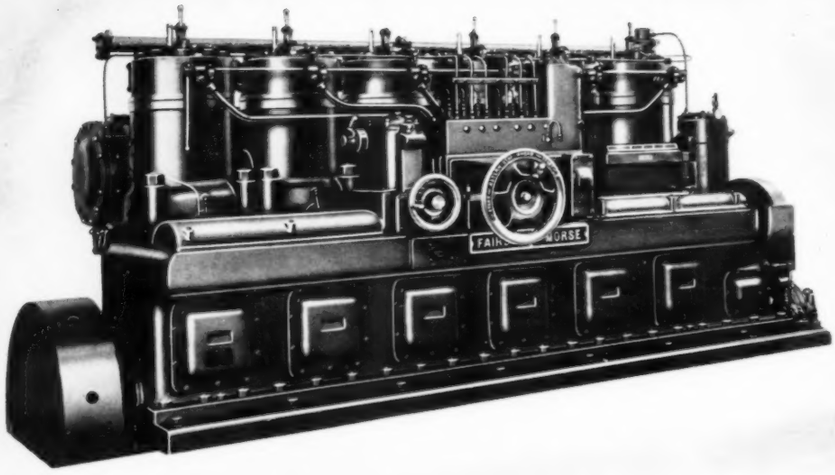
Hamilton, Ohio

DIVISION OF GENERAL MACHINERY CORPORATION

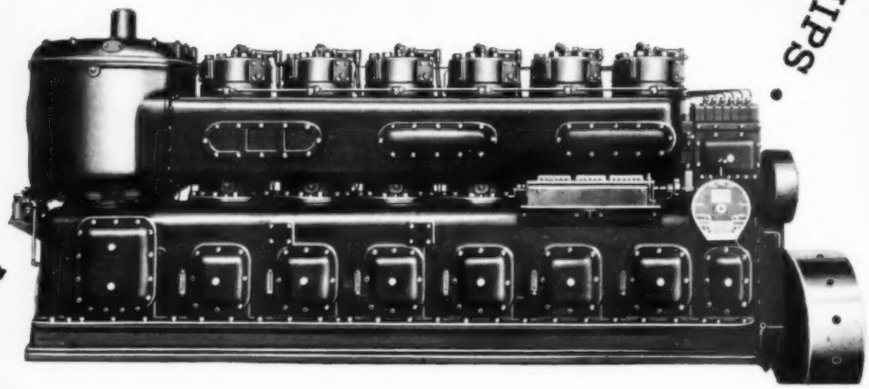
Marine Diesels



TUGS • FERRIES • CARGO VESSELS • MOTORSHIPS •



• TRAWLERS • WORK BOATS • FISHING CRAFT •



To Exactly Fit Every Marine Need

What Diesel is best for your craft? What type, size and horsepower will be the most efficient in your hull? Which Diesel will give the most in ease of control, maneuverability and dependable operation in every weather? Which engine is best for a specific auxiliary service?

Fairbanks-Morse men never have to compromise on their recommended solutions of important problems! Because in the big, complete line of F-M Marine Diesels, there is one which is exactly suited to every need. You know *in advance* that the Diesel recommended is not one which can be "made to do" for your craft, but one which was specially designed and selected to do the job you require of it.

If you are planning to convert or to build, find out about Fairbanks-Morse Diesel service—how it will give you more for your money in operating efficiency, easier handling and lower costs. For full information, address Department D81, Fairbanks, Morse & Co., General Offices: Chicago. New York—Boston—Baltimore—New Orleans —Jacksonville—Los Angeles—San Francisco—Portland, Oregon—Seattle. Branches with service stations in principal ports. Service facilities throughout the world.

61408A27-462

FAIRBANKS-MORSE *Marine Diesels*

106 YEARS OF PRECISION MANUFACTURING

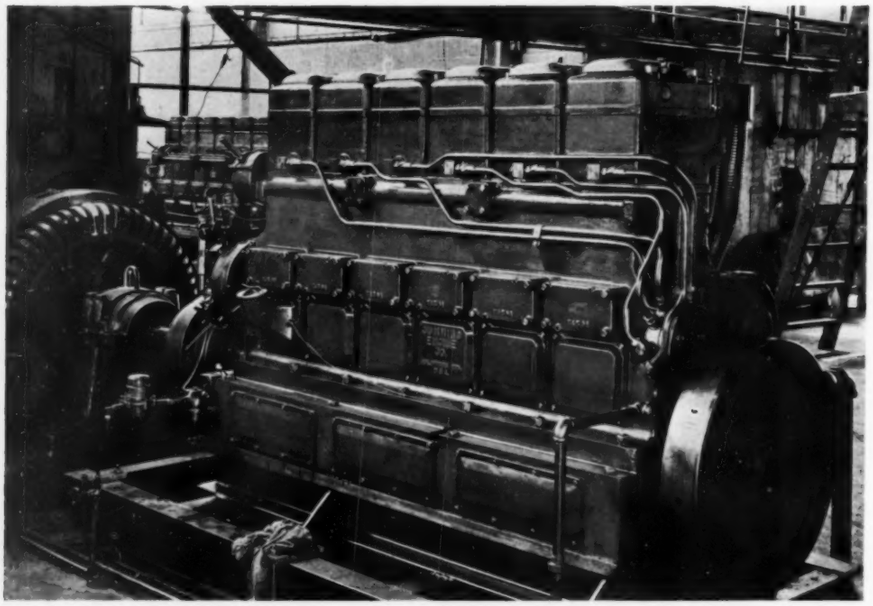
NEARLY THREE MILLION HORSEPOWER NOW IN SERVICE

CUMMINS ENGINE COMPANY

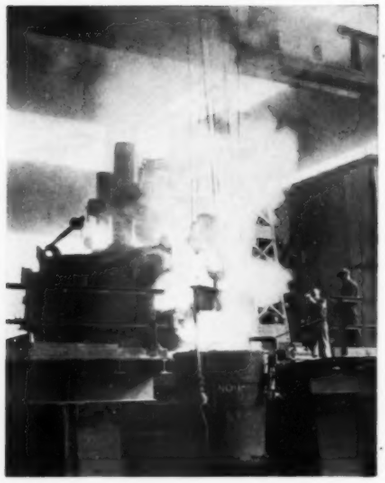
use

National Forge & Ordnance Co. Products

CONSISTENTLY fine quality of material, combined with accurate workmanship to micromatic limits, places National Forge & Ordnance Company Crankshafts in an outstanding position among Diesel Engine Manufacturers.



The Cummins Engine Company are particularly proud of the crankshaft used in this, their Model K type of engine, 6¾" x 9", rated at 170 hp. at 800 r.p.m., in the 6-cylinder unit, because of the large main bearing diameters used in relation to horsepower development.



Complete control of all Processing from selection of the melting charge to the finished condition is National Forge and Ordnance Company's guarantee for maintenance of quality in Crankshafts and various other types of forgings furnished to leading manufacturers in the Diesel Industry.

BASIC ELECTRIC STEEL FORGINGS

CARBON, ALLOY, CORROSION RESISTANT AND SPECIAL STEELS SMOOTH FORGED, HOLLOW BORED, ROUGH OR FINISHED MACHINED, HEAT TREATED TO SPECIFICATIONS . . . FORGING QUALITY INGOTS—PRESSED OR HAMMERED BILLETS

National Forge & Ordnance Co.

Irvine, Warren County, Penna.

"Eminently Satisfactory in every way" — says John Barrymore

IN CHINA, from whence much oriental wisdom has been absorbed by sea faring men of the Western world, they evolved the axiom: "If you would know the road—ask one who has traveled it." Accepting this truism, an old San Francisco sea captain interested in the purchase of a Diesel engine, wrote to John Barrymore and asked his opinion of the Atlas Diesels installed in his famous yacht "INFANTA."

In asking the opinion of John Barrymore, he chose a man who has certainly traveled the roads of the world and should render a discriminating opinion. Few yachtsmen have cruised so much and so thoroughly enjoyed their boats as has John Barrymore. When he replied to the old San Francisco sea captain, this is what he wrote:

"Your letter of October 8th just received, and I hasten to reply to it, as I am very glad to be able to inform you that the Diesel engines in my yacht "INFANTA" have been EMINENTLY SATISFACTORY IN EVERY WAY, and my engineer, who is a man of great judgment and experience, says they are the finest engines he has ever handled.

"I wish also to add that the great and consistent courtesy I have experienced from the Atlas Imperial Diesel Engine Co. is an added element in favor of doing business with them. I certainly would not think of installing any other engines than theirs if I were building another boat."

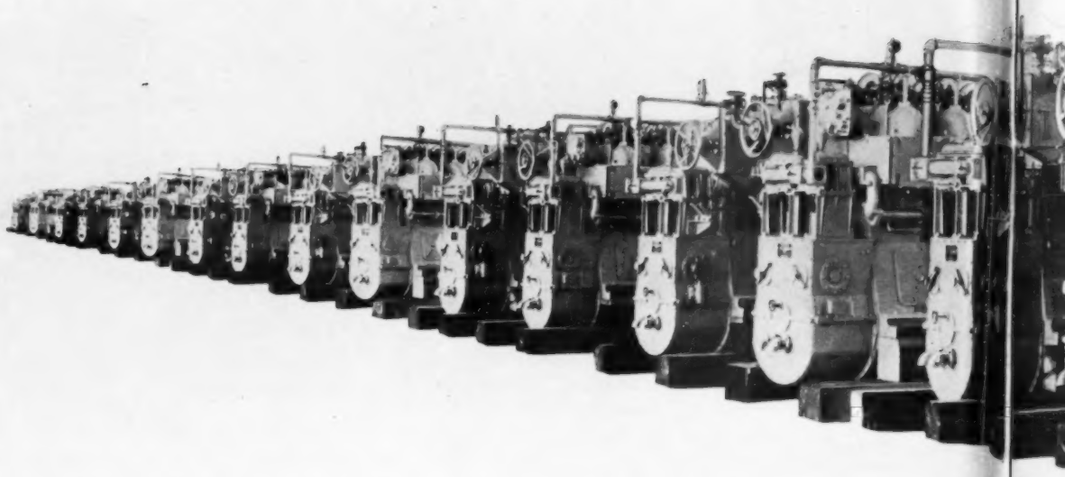
When you select an engine for your boat, profit by the experience of yachtsmen of judgment who can afford to buy the best. So much of the pleasure of the sea depends upon the reliability of your power plant that you cannot afford to experiment. You will choose wisely when you select the old dependable ATLAS DIESEL.

ATLAS IMPERIAL DIESEL ENGINE CO.
OAKLAND, CALIFORNIA • MATTOON, ILLINOIS

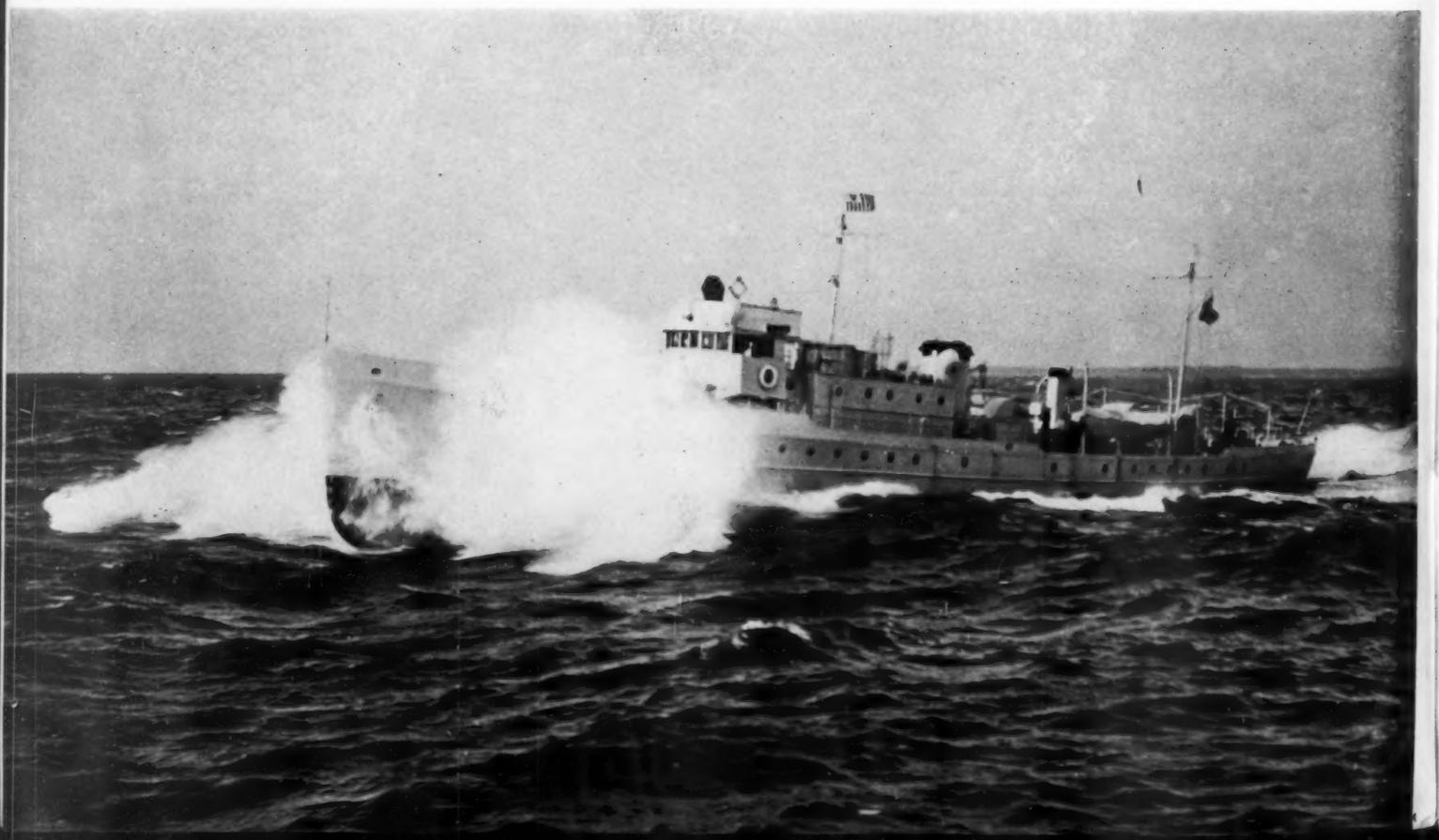
ATLAS IMPERIAL

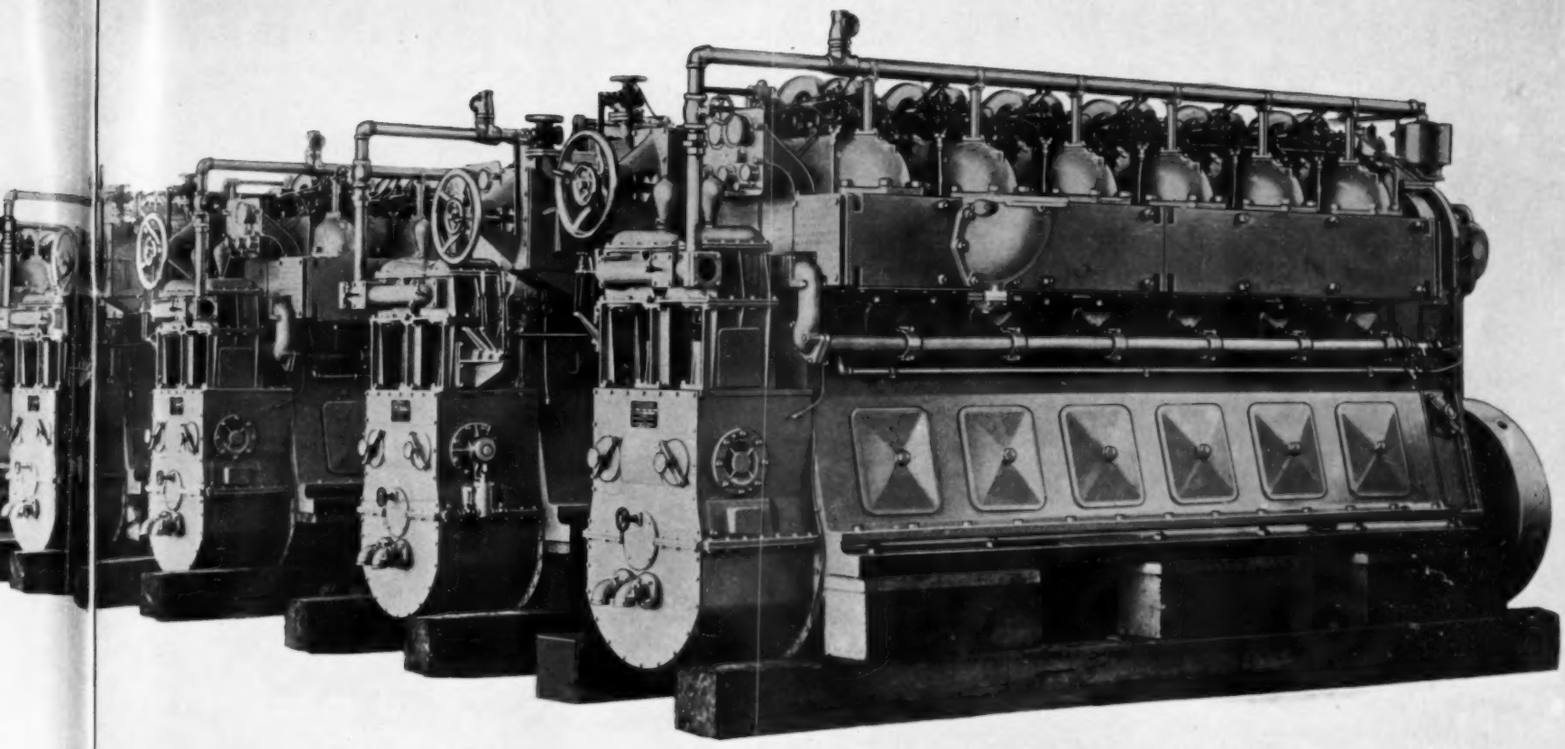
Thirty-six 670 hp. Diesel engines built by Winton Engine Corporation for installation in eighteen United States Coast Guard cutters. These engines, together with fifty-four auxiliary engines included in the contract, are equipped with American bearings.

Below — U. S. C. G. Cutter "Thetis," length 165 ft., beam 25 ft., draught 13 ft. — one of the vessels powered with the Winton Diesels illustrated.



BEARINGS ARE BOUGHT O





HT ON THE BASIS OF PERFORMANCE

WHAT bearings *DO* is of vastly greater importance than what bearings *COST*. One premature failure can easily cost more than the price of hundreds of bearing installations. Our bearings are designed, fabricated, installed and sold with one paramount objective—to give honest trouble-free service.

Our specialized experience in making bearings for Diesel engines for all types of work should interest Diesel builders and operators. We solicit your inquiries.

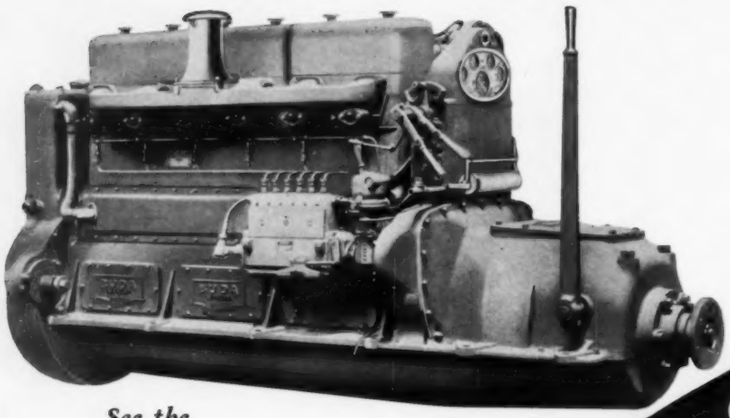
AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS INDIANA

CENTRIFUGAL American Bearings FORCE

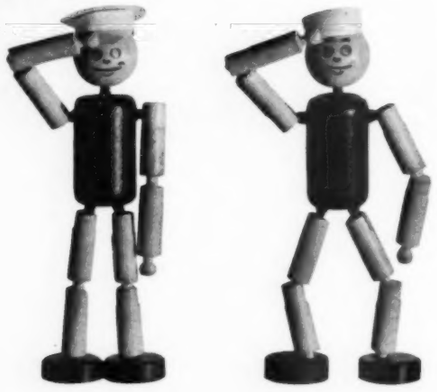
Never before a Diesel engine like this!



See the
BUDA EXHIBIT
at the National Motor Boat Show
Grand Central Palace
New York City
January 17 to 25
SPACE W
Mezzanine Floor

BUDA
SILVER CROWN
MARINE ENGINES

Buda leads again



BUDA-LANOVA Silver Crown Diesel Engines bring you tried advantages never before offered the American Boating Public. Advantages that mean even quieter and smoother operation with lower operating costs.

Here are advantages worth having.

Soft Combustion: **A rate of pressure rise well within the limits of gasoline engines, assuring smoother operation and longer life to reciprocating parts.**

Low Compression Ratio: **Only 12½ to 1, making them more comparable to gasoline operation. Compare this with other high speed Diesels where compression ratios run 15 to 1, even 20 to 1.**

High Workable Mean Effective Pressure: **Due to the excellently organized and controlled turbulence for combustion! High Mean Effective Pressure without High Combustion Pressures assures greater economy and power with less wear and tear on bearings and reciprocating parts.**

Buda-Lanova Silver Crown Diesel Engines have nozzles of large orifice. They do not clog and require no cleaning. No flame or fuel strikes the cylinder or piston walls. Piston temperatures are no higher than in gasoline practice and are far lower than other types of Diesels. Injection pressure is low, reducing wear and tear on reciprocating parts of the injection system.

Boat owners and prospective boat owners should know about this advanced Diesel design, its ease of control, low cost operation and ease of starting. It brings new Diesel dependability and safety to boating. Don't buy a Diesel before seeing the *Buda-Lanova Diesel Engine.*

THE BUDA COMPANY

Marine Engine Division K
HARVEY (Chicago Suburb) ILLINOIS

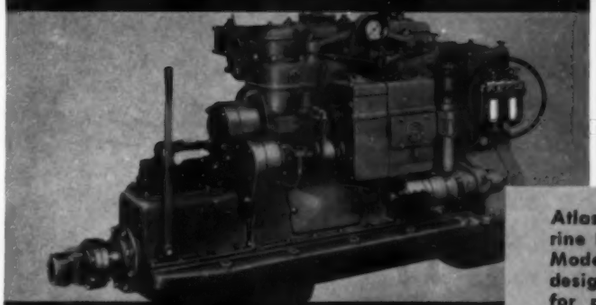
A GROUP OF CHAMPIONS

Here is the winning crew that Piloted . . .

Left to Right
G. N. Somerville
G. F. Twist
G. J. Brusher
A. Olin
J. A. Wright

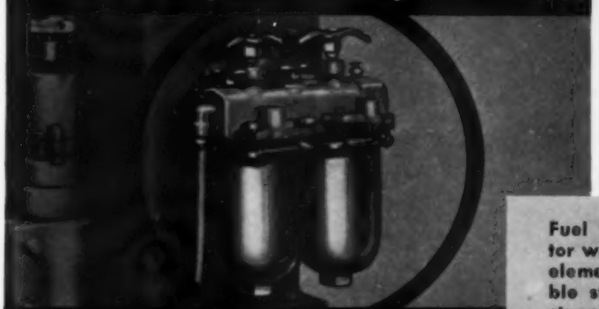
The winning boat that was driven by . . .

Forty foot cruiser "Atimco" entered in 4 of the 5 races held in San Francisco Bay—and winner in every start.



The Atlas Diesel Engine that was protected by . . .

Atlas Imperial Marine Diesel Engine Model 4 AM 115—designed especially for pleasure craft and small fishing boats.



The Purolator Oil Filter

Fuel filter—Purolator wool and metal element type—double strainer . . . 4 stages of filtration. Oil Filter Purolator metal element type.

THE New Atlas Imperial Marine Diesel—Model 4 AM 115, designed especially for pleasure craft and small fishing boats, is proving a winner on many counts. Its simple, sturdy construction, its cruising radius, its economy of operation, and its safety have marked it as a definite engineering achievement.

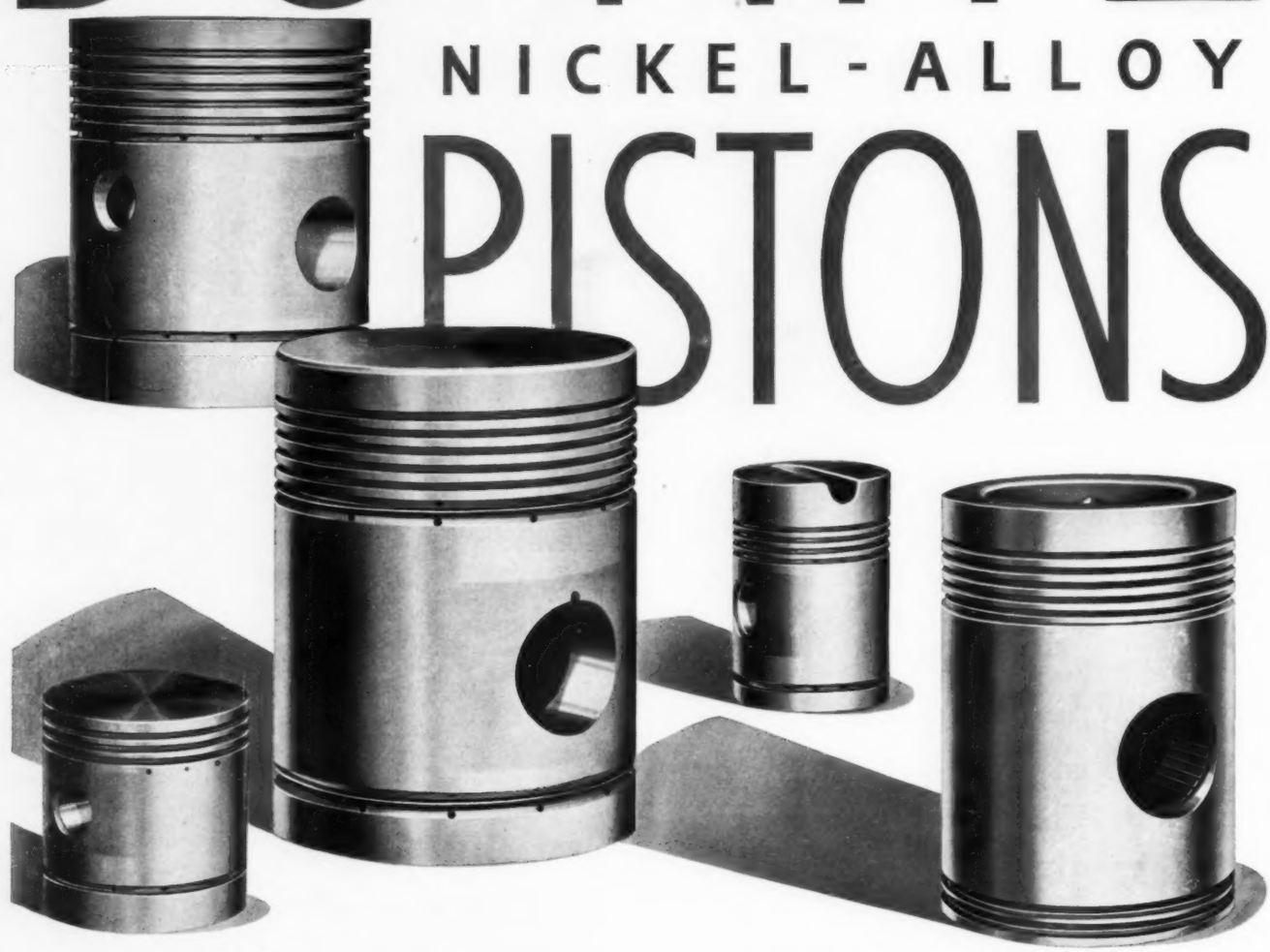
Note that this engine's fuel supply and its lubricating system are protected by Purolator Oil Filters. The Purolator is glad to be in this company. Purolator engineers have kept in step with all characters of Diesel progress, and invite inquiries for any type of filter that you have in mind. Motor Improvements, Inc. 365 Frelinghuysen Ave., Newark, N. J.

PUROLATOR

The Oil Filter

BU-NITE

NICKEL-ALLOY PISTONS

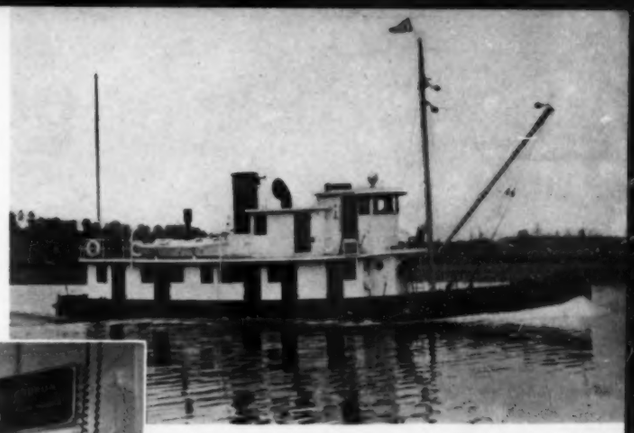


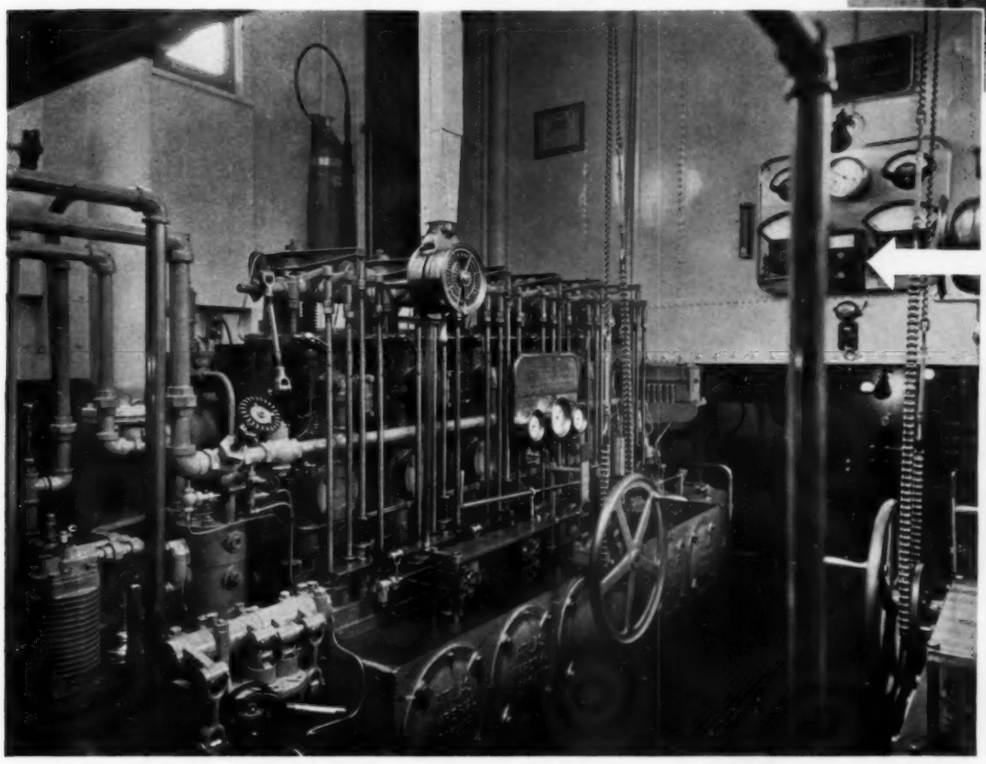
Each Bu-Nite Nickel-alloy Piston is designed for a specific type of service. Every one is carefully engineered for the engine in which it is to be used. With the development of higher speeds in Diesel engines and the need for obtaining greater horse-power per engine, Bu-Nite pistons are more than ever filling a definite need for a lightweight piston that will run cool under the most severe load conditions and require the minimum of attention.

Our Engineering Department will welcome an opportunity to talk over your piston problems with you and to submit a Bu-Nite design for your engine.

DELCO-REMY CORPORATION, ANDERSON, INDIANA, U. S. A.

"ALNOR"
EXHAUST PYROMETERS
Selected to Serve Atlas Diesels of Lighthouse Tender "Rhododendron"





Lighthouse Tender "Rhododendron" designed under direction of R. R. Tinkham, Supt. Lighthouses Seventeenth District. Built by Commercial Iron Works, Portland, Ore.

The arrow at left shows the "Alnor" exhaust pyrometer (partly obscured by the post) which is mounted on the instrument board located conveniently in the engine room. This is an "Alnor" Model RB with sufficient switch capacity to handle both 6-cylinder Atlas Imperial Diesel engines with which the "Rhododendron" is powered.

THE "RHODODENDRON," which is used on the Columbia and Willamette Rivers, encounters a wide variety of navigation difficulties. For such service it must be extremely flexible.

The "Rhododendron" is the first twin screw, tunnel type Diesel powered tender to be constructed for the Lighthouse Service.

It is powered by a pair of 120 hp. Atlas Imperial Diesel engines. All modern instruments to safeguard the efficient, continuous performance of the engines are provided, including exhaust pyrometers.

An "Alnor" pyrometer, because of its time tested ability on many government vessels to give long reliable service under most severe conditions, was chosen to serve this outstanding Lighthouse tender.

Whether the service is for the stationary plant, the more severe conditions of the mobile Diesel, or the exacting requirements of marine installations, there is an "Alnor" pyrometer designed and built to meet the requirement.

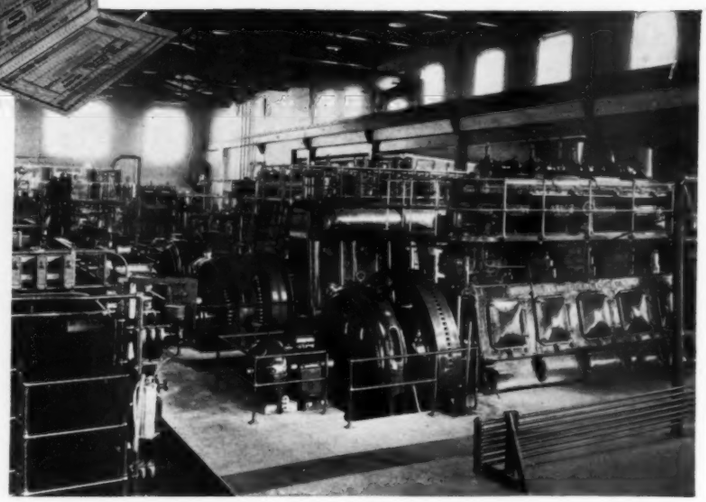
WRITE FOR CATALOG

ILLINOIS TESTING LABORATORIES, Inc.
423 North LaSalle Street • Chicago, Illinois

Testing Engineers and Manufacturers of "ALNOR" and "PRICE" Pyrometers
The Products of 35 Years' Experience

"Alnor" Pyrometers—*The Engine X-Ray*

THIS POWER PLANT *bought a Round-Trip Ticket*



Started as a joy-ride, it proved the Chief's judgment... 100%

The experience of the Sioux Falls Water Works, at Sioux Falls, South Dakota, is a tip for Diesel users everywhere.

This plant had been on the same brand of lubricants for more than five years. Then came a competitive sales-barrage. The Chief agreed to make a test . . . with the competitor's oil in two units . . . and keeping Texaco in three.

Here is the record of Texaco Ursa Oils after a year's test:

IN SERVICE TO INDUSTRY

All important Diesel manufacturers approve Texaco Ursa Oils for the lubrication of the equipment they make.

Not a single shut-down due to faulty lubrication.

Not a single stuck piston-ring, and no sludging.

Complete compression-seal in all the cylinders.

Efficient oil film in bearings under all conditions.

More h.p. hours per gallon.

The result was that this plant is right back where it started . . . with Texaco Ursa Oils in all five units.

The Sioux Falls Water Works has set an all-time maintenance record — 50% lower than formerly. Even its oil bill has been cut 15%.

Write to The Texas Company and we will send our representative to serve you.

•

THE TEXAS COMPANY
135 East 42nd St., New York City

Nation-wide distribution facilities assure prompt delivery

TEXACO *Industrial Lubricants*

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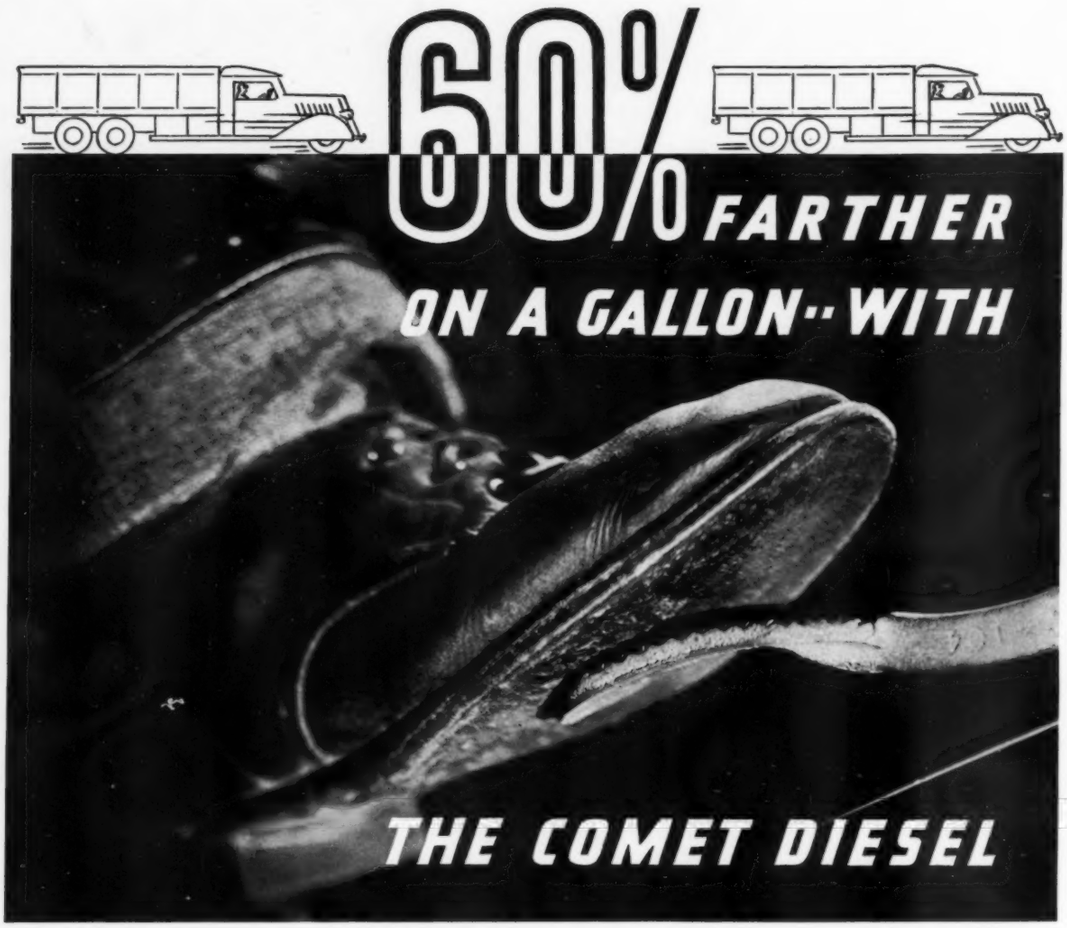
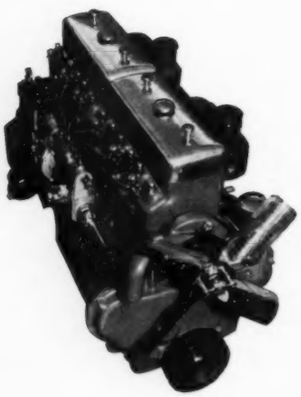
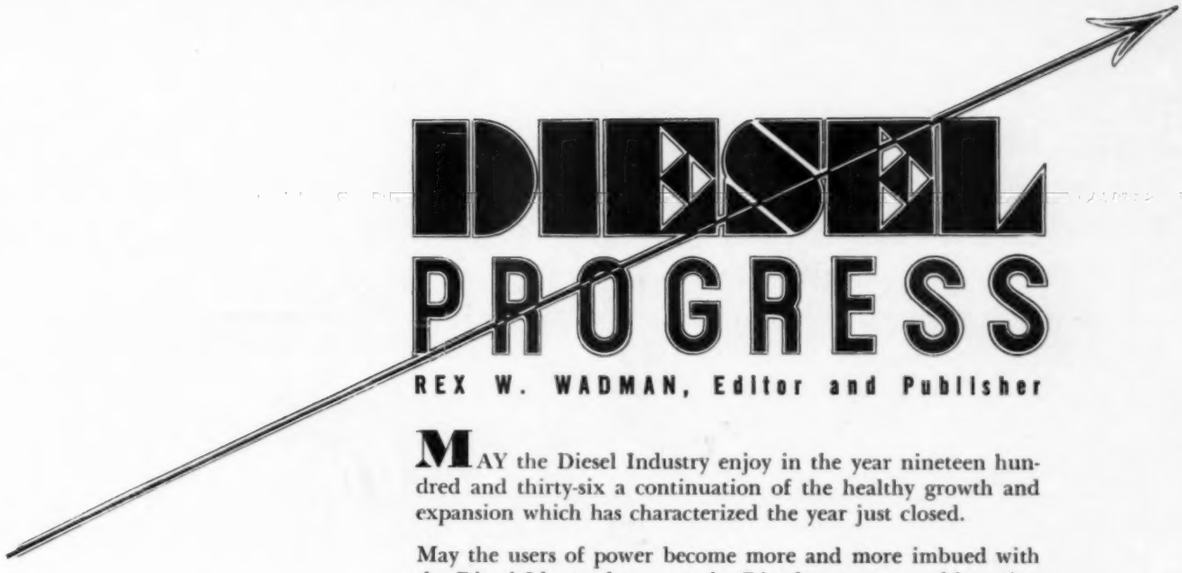




• An automotive vehicle with a Comet Type Diesel Engine will run about sixty per cent farther on a gallon of fuel than the same one powered with a gasoline engine. And the fuel cost per mile of the Comet Diesel will be about one-sixth as much as that of the gasoline engine. These are facts. Accurate tests have proved them. That's why the Comet Type Diesel... built exclusively in America by the Waukesha Motor Company...is the preferred type for automotive work everywhere. *Write for Bulletin 1001. Waukesha Motor Company, Waukesha, Wisconsin.*

WAUKESHA ENGINES



DIESEL PROGRESS

REX W. WADMAN, Editor and Publisher

MAY the Diesel Industry enjoy in the year nineteen hundred and thirty-six a continuation of the healthy growth and expansion which has characterized the year just closed.

May the users of power become more and more imbued with the Diesel Idea and turn to the Diesel as a means of lowering their power costs.

May the prospective Diesel Engine Buyer enter the negotiations with an open mind, with a real desire to be "shown" that his power costs can be lowered and when "shown" be progressive enough to buy the necessary Diesel equipment to insure those savings.

May the idea of municipal ownership spread and expand across the country in nineteen hundred and thirty-six, thereby increasing the demand for economical Diesel engines and automatically decrease the tax burden in the cities and towns adopting municipal ownership.

May the use of Diesel Engines spread, in this country, to airplanes of all types, thereby removing the ever present fire hazard and automatically increase the cruising radius through better engine economy and efficiency.

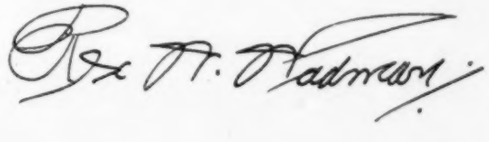
May the use of Diesel Engines continue to spread amongst the owners and builders of comparatively small yachts, thereby eliminating the risk of explosion or fire and thereby increasing cruising range and materially decreasing operating costs.

May the Diesel Engine Manufacturer appreciate fully the responsibility resting on his shoulders in the tremendous increase in the demand for Diesel Engines and make certain that each and every engine sold will give a good account of itself.

May he continue to carry on his experimental and research work in the laboratory rather than in the power houses of his users.

May the Diesel Engine Salesman continue to carry on the splendid work which has characterized his activities during the past year, paying particular attention to each buyer's needs and checking carefully that the engine sold be neither too small, too large or otherwise unfitted for the installation.

May DIESEL PROGRESS continue to serve the industry to the complete satisfaction of the industry and of our readers and to be favored with the quiet but steady increase in volume of advertising which has characterized our last four issues.

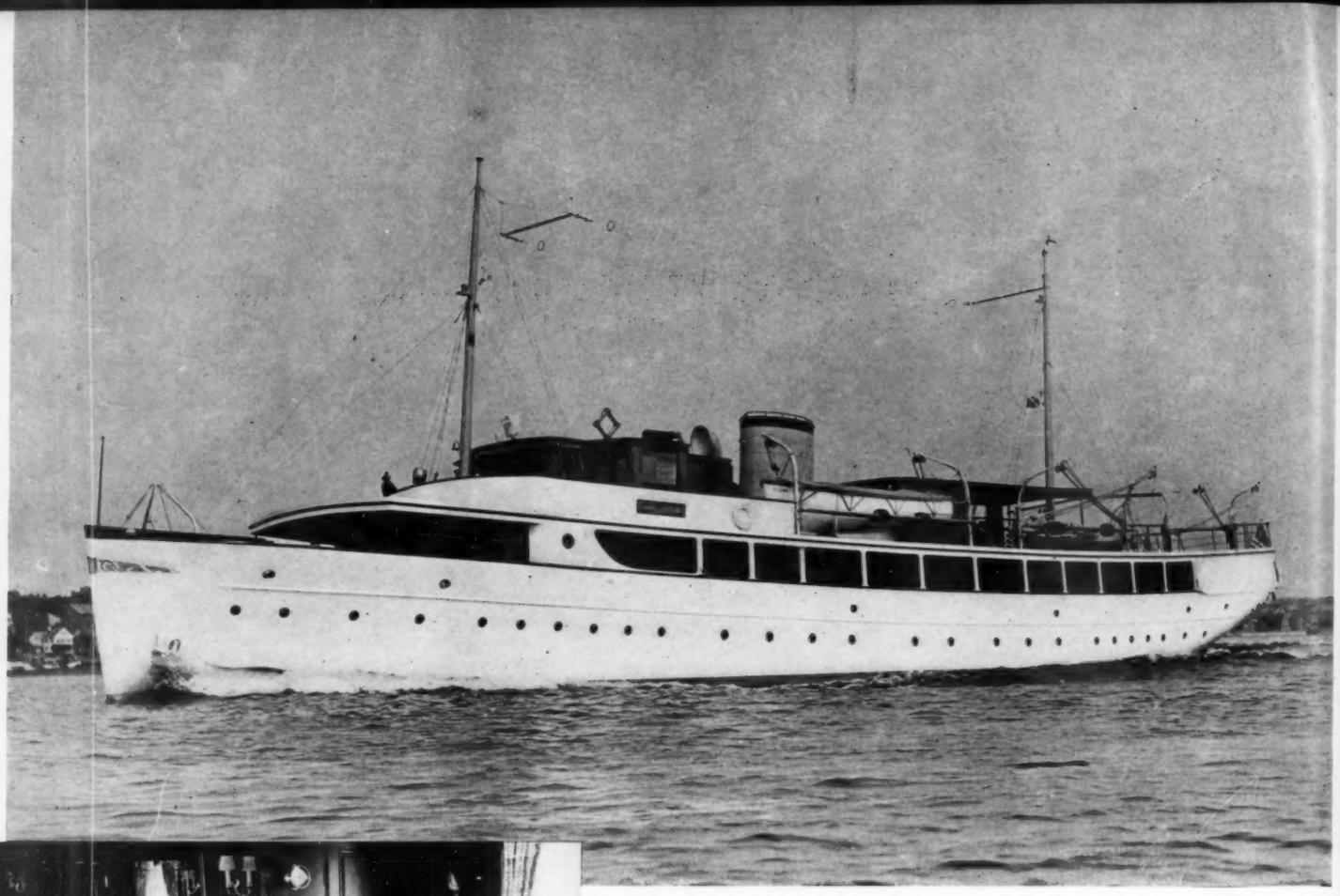


WHAT IS PRAYER?

Prayer is the soul's sincere desire,
Uttered or unexpressed—
The motion of a hidden fire
That trembles in the breast.

Prayer is the burden of a sigh,
The falling of a tear,
The upward glancing of an eye
When none but God is near.

— JAMES MONTGOMERY



The "Halonia" is beautifully furnished throughout as is typified by the dining saloon illustrated to the left and the main saloon illustrated hereunder. The Raphael Studios are responsible for the pleasing and homelike effect so noticeable not only in these two rooms but throughout the vessel.

HALONIA G

And So Will Many Like Her.

TYPIFYING a trend in yacht circles is the *Halonia* which was one of the last of the Diesel yachts to be built in 1929, enjoying but a short period of activity and then was laid up. The *Halonia* has recently been purchased by a prominent eastern yachtsman and is now in active service and will be extensively used in southern waters this season. Just as the *Halonia* has gone into commission again so will many other yachts of her same general type during the coming winter.

GOES BACK INTO SERVICE

Designed by Henry J. Gielow, Inc., and built by the Bath Iron Works in Maine, the *Halonia* has two accommodation features rarely found in this type of vessel. The owner's stateroom and bath are on the weather deck as is the galley, located just forward of the dining saloon. This latter arrangement permits a minimum of stewards and effects a considerable saving in crew complement.

Her interior furnishings were designed and executed by the Raphael Studios of New York, and as the illustrations clearly show, provide a homelike and pleasing atmosphere for extensive cruising. No detail has been neglected for the comfort and convenience of the owner and guests whether on an off-shore fishing trip or a round-the-world cruise. A few typical examples are both long and short wave radio and a Thermofan system for heating, cooling and ventilating.

The principal dimensions are: length 147' 9", beam 24' 10" and draft 8' 6". *Halonia* is practically a sister ship of *Helene*, owned by Charles Sorenson of the Ford Motor Company and Senator Metcalf's *Felicia* and, like them, is powered by Cooper-Bessemer Diesels. There are two direct drive, direct reversible main propulsion engines and two 50 kw. auxiliary generating sets, also Cooper-Bessemers. The main engines develop 400 hp. each at 600 rpm. and provide a cruising speed of 15 miles per hour. With a fuel oil capacity of 11,000 gallons, the cruising range is approximately 6,000 miles. She carries 6,000 gallons of fresh water and a correspondingly ample supply of ship's stores for protracted voyages.

In the field of the large Diesel yachts, this trim yet spacious vessel stands out as probably the best all around size. She is easily and well handled by a total crew of sixteen yet still embodies all the space and requirements for long range service. Safety and economy are built in with her modern marine Diesels which also, due to their positive and flexible operation, guarantee maximum maneuverability.

The Bristol "Phoenix" installed in a Westland "Wapiti" airplane.

THE ROYAL AERO CLUB
OF THE UNITED KINGDOM

CERTIFICATE OF PERFORMANCE
(UNDER THE COMPETITION RULES OF THE ROYAL AERO CLUB)

The object of the trial as declared by the Entrant was to establish a world's altitude record for an aircraft fitted with a Compression Ignition Engine

Engine	Bristol "Phoenix" Compression Ignition
Constructors	The Bristol Aeroplane Co. Ltd. Filton House, Bristol
Type	9 cylinder air cooled radial
Bore and Stroke	5·75" x 7·5"
Swept Volume	1753 cu. ins.
Engine R.P.M.	1900 normal, 2000 maximum
Airscrew Ratio	0·655 engine speed
Rated Power at normal R.P.M.	415 B.H.P.
Take-off Power at normal R.P.M.	470 B.H.P.
Power at maximum R.P.M.	430 B.H.P.
Weight complete	1090 lbs.
Fuel used	Persian Gas Oil Specific Gravity 0·839
Aircraft	Westland "Wapiti"
Constructors	Westland Aircraft Works, Yeovil
Date	11th May 1933
Place	Yeovil
Performance	
Altitude	Metres 8370 Feet 27,453

Chairman

Secretary

Official certificate confirming the Bristol "Phoenix" altitude record.

DIESEL AIRCRAFT ENGINES IN GREAT BRITAIN

By PAUL H. WILKINSON

IN Great Britain, research work on Diesel, or compression ignition, aircraft engines dates back to 1926. A good deal of the work was done by The Royal Aircraft Establishment, Ricardo, and Rolls-Royce, in conjunction with the British Air Ministry. Single cylinder experiments showed considerable promise, and the Rolls-Royce "Condor," a twelve-cylinder, water-cooled gasoline engine, was converted to Diesel operation. It developed 480 hp. at 1,900 rpm., and was successfully flight tested in a Hawker "Horsley" torpedo bomber in 1933.

To meet the need for power plants for H.M. Airship R-101, Beardmore produced an eight-cylinder, in-line, steam-cooled engine known as the "Tornado." It was rated at 585 hp. at 900 rpm. and weighed 4,550 lbs., or 7.78 lbs. per hp. Five of them were installed on the airship, which was unfortunately lost in a storm on its trial flight.

The first really practical Diesel engine was the Bristol "Phoenix," built by The Bristol Aeroplane Co., Ltd. It represented the culmination of over eight years' work for the Air Ministry, during which time over fifteen hundred hours of test runs were made. The preliminary experimental work was done on an air-

cooled cylinder having a bore and stroke of 8 in. by 11 in. This size was reduced, however, when the "Phoenix" was built, to a bore and stroke of 5.75 in. by 7.50 in., giving it a displacement of 1,753 cu. in., which was the same as that of the Bristol "Jupiter" gasoline engine.

For test flights, the "Phoenix" was installed in a Westland "Wapiti" general purpose airplane of a type then in use by the Royal Air Force. This Diesel-engined airplane made its first appearance at the Royal Air Force Display in June, 1933, and attracted great attention. At that time it was not supercharged, and it then went back for further improvement, reappearing in its supercharged form the next year.

On May 31, 1934, the "Phoenix" in the "Wapiti," under the skillful piloting of Mr. H. J. Penrose, test pilot of the Westland Aircraft Co., made the official world's altitude record for a Diesel-engined airplane of 27,453 ft. The engine and the airplane are illustrated herewith, the photograph having been taken just before the actual flight. It will be noted that the installation was quite conventional for a radial engine, and a standard type of engine cowling and exhaust collector ring were used. The official certificate of performance, as issued by the Royal Aero Club, is reproduced.

The maintenance of power at altitude was found to be considerably better for the "Phoenix" than for the "Jupiter," due to the fact that the Diesel engine used an excess of air at low altitudes, which was of advantage when air of less density was encountered at high altitudes. This was clearly demonstrated in a series of test flights, trying out the "Phoenix" and the "Jupiter" in the same airplane. The results were conclusive, as the "Jupiter" VIII F engine used was of approximately the same power as the "Phoenix."

At the top of its flight, the temperature of the air was –40° F., but no trouble was experienced with the Persian gas oil used for fuel. This is a standard commercial crude oil with a specific gravity of 0.839, which is obtainable throughout the world. The fuel consumption at cruising speed was 35 per cent less than that of the "Jupiter."

The Bristol "Phoenix" is shown on the right. It is a conventional four-cycle, nine-cylinder, air-cooled radial engine, which is rated at 415 hp. at 1,900 rpm. at an altitude of 7,000 feet. The take-off power is 470 hp. at 1,900 rpm. Its weight is 1,090 lbs., or 2.63 lbs. per hp. On the rear part of the crankcase are two Bosch fuel pumps which supply fuel to an injector in each cylinder at a pressure of 3,500 lbs. per sq. in. Two inlet and two exhaust valves are used.

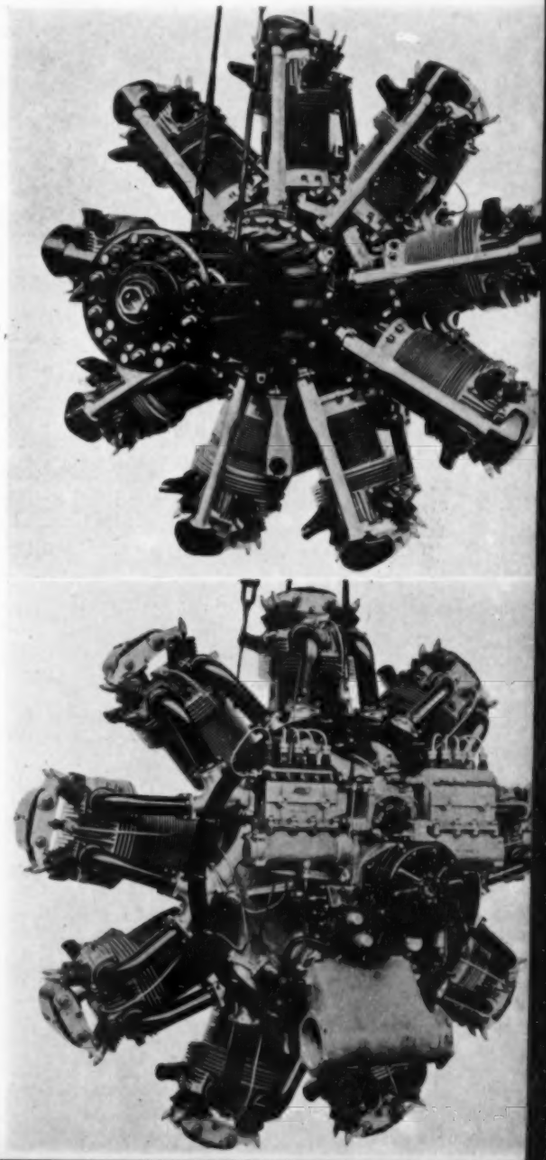
The other firm in Great Britain which has been active recently in the development of the Diesel aircraft engine, is D. Napier & Son, Ltd. They also did considerable research work for the Air Ministry on single cylinder units. In 1933, they acquired a license for the Junkers "Jumo" 4 and "Jumo" 5, six-cylinder, vertically opposed, water-cooled engines which had given highly satisfactory results in Germany. The British engines are known as the Napier "Culverin" and "Cutlass" respectively.

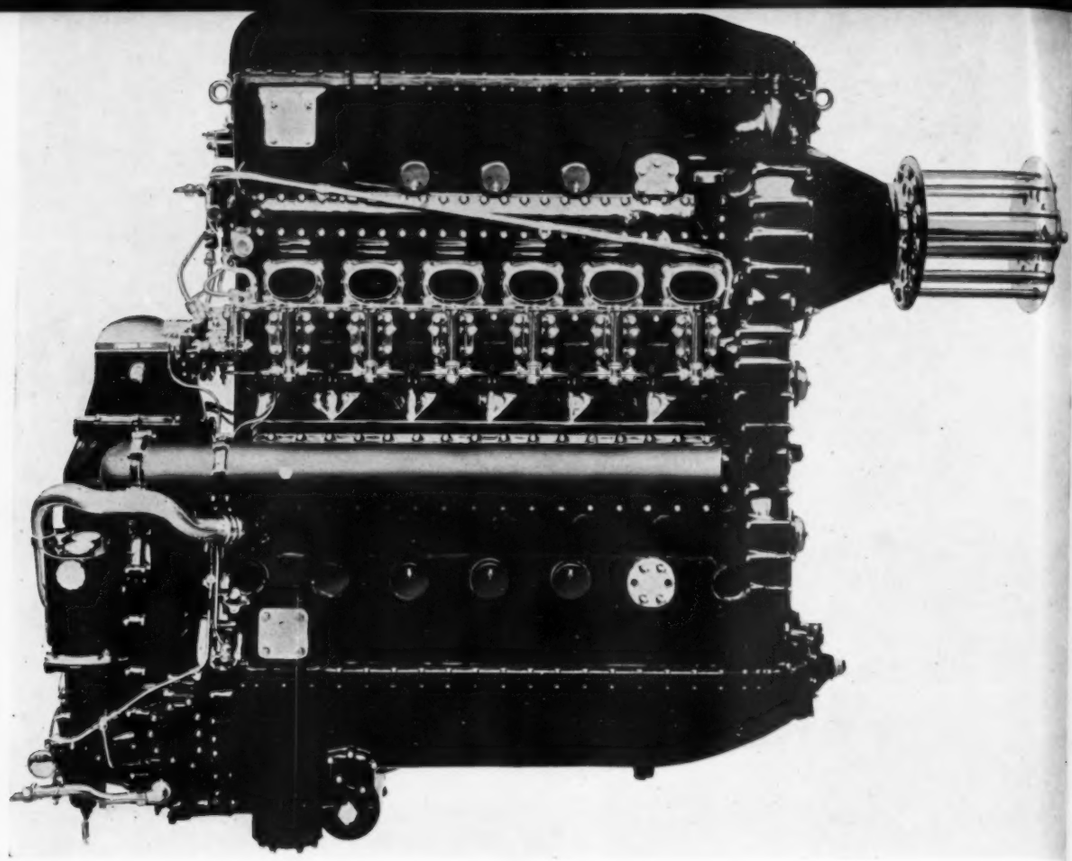
The larger engine, the "Culverin," is now in production and will soon be flight tested in both military and commercial aircraft. It is rated at 720 hp. at 1,700 rpm. at sea-level, and weighs 1,786 lbs., or 2.48 lbs. per hp. The bore and stroke are 4.75 in. by 2 x 8.25 in. respectively, giving it a displacement of 1,754 cu. in., which is the same as that of the Bristol "Phoenix." It will be noted that although it develops a good deal more power than the latter engine, its weight per hp. is considerably less.

A side view of the "Culverin" is shown. Underneath the exhaust ports are the fuel pumps, and directly below each of the latter are the connections to two fuel injectors. There is a similar arrangement of pumps and injectors on the other side of the engine. Air from the centrifugal type supercharger is supplied through delivery pipes along each side of the engine to ports in the lower part of the cylinders.

The rear view of the engine shows its extreme narrowness. The supercharger is in the center, below it is the water pump, and on the left is the compressed air starter.

Bristol "Phoenix," three-quarter front view. Bristol "Phoenix," three-quarter rear view.





Napier "Culverin" – side view.

Napier "Culverin" – rear view.

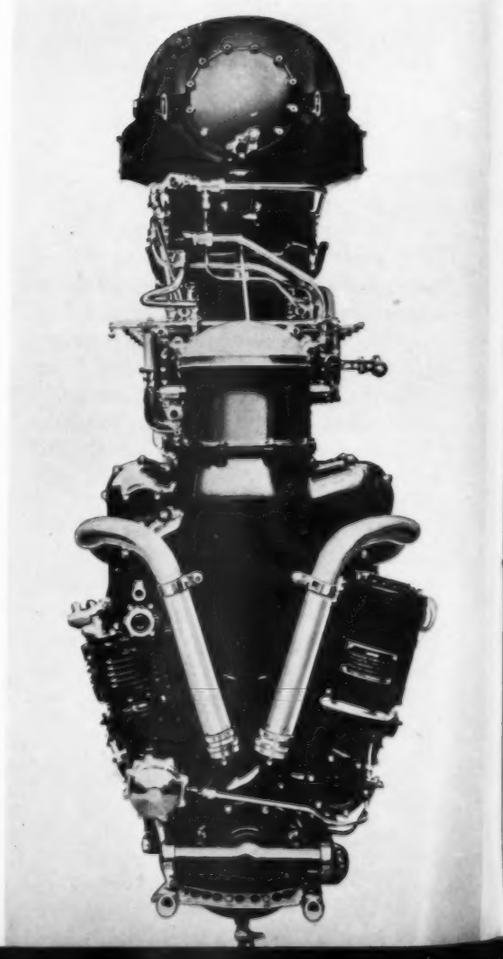
The smaller Napier engine – the "Cutlass" – is not yet in production, as work is being pushed on the larger engine. This is the reverse of the case in Germany, where the smaller model – the "Jumo" 5 – is being rapidly developed to greater power output, and the larger model – the "Jumo" 4 – is practically the same as when it was finally type-tested.

The "Cutlass" is credited with a power output of 535 hp. at 2,100 rpm. at sea-level, and an approximate weight of 1,124 lbs., or 2.10 lbs. per hp. Like the "Culverin," it is supercharged, using a single stage, centrifugal type blower.

The development of the Napier engines will be watched with great interest, as they represent the most advanced Diesel aircraft engines in Great Britain today.

Another interesting engine, of which more should be heard, is the Beardmore twelve-cylinder, opposed-type, water-cooled engine which was developed subsequent to the airship engine previously mentioned. It was a four-cycle engine, with two banks of six cylinders arranged at 180 degrees, which in its unsupercharged form developed 500 hp. at 1,750 rpm. for a weight of 1,450 lbs., or 2.90 lbs. per hp. The design was particularly attractive, as its shape allowed it to be installed in the wing of an airplane completely out of sight, and with no head resistance except that of the propeller hub. In supercharged form, and with the mechanical improvements now made possible by experience in the art since 1930, it should compare very favorably with present-day engines.

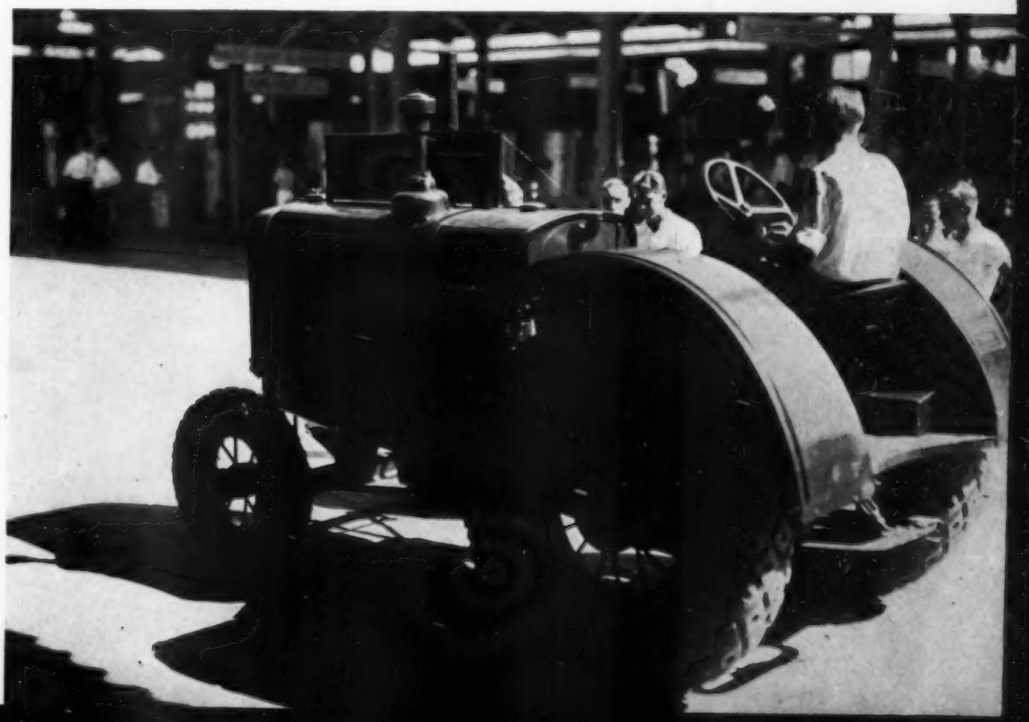
Other experimental work is going on, but no details can be released for publication as yet. But in view of the high cost of gasoline, which has to be imported into Great Britain, and because of the great distances involved between the different parts of the British Empire, it would seem only logical to expect that the Diesel engine should become a serious competitor of the gasoline engine for aircraft use on account of its lower fuel consumption, lower fuel cost and, most important of all – the elimination of the fire hazard.



TRACTOR SHOW

The new and the old at the California State Fair—An Allis-Chalmers Diesel Tractor beside an oxen-drawn high wheel logging cart.

This big Cletrac 80, powered with a Hercules Diesel, was the biggest Diesel tractor at the Fair this year, which was dominated by Diesel-driven equipment.



The latest thing in Diesel tractors—the International Harvester WD-40 was really the only new piece of equipment shown before California's record fair crowds this year. Intense interest was shown in this air-tired unit.

"OIO"

Elco Diesel Cruiser for Hawaiian Islands

MARLIN, tuna and sailfish have had an adversary worthy of their steel for some years in the person of Mr. John Waterhouse, prominent sugar factor of the Hawaiian Islands. In the near future, however, such game fish inhabiting the sparkling blue waters off Honolulu will meet the last word in deep-sea, sport fishing equipment – his new Diesel-powered cruiser. For the past five years Mr. Waterhouse has made constant use of a 38-ft. gasoline cruiser, which served him well, but was forced to give way to the modern, light-weight, high-speed marine Diesel. In order to forestall the danger of fire at sea and increase his cruising range and operating economy he selected another Elco Cruisette of the same size, but powered by twin Diesels.

The *OIO* is of typical Elco design, except for the after cockpit, where two swivel fishing chairs are installed and a commodious fish box is built in, designed to drain overboard. Also, the eight-foot dinghy is carried out of the way on the cabin roof, where it is instantly stowed or broken out by one man handling the special Elco launching gear. This is, in effect, merely a miniature marine railway, which operates over the stern and is simplicity itself.

With a fuel capacity of 300 gallons and Diesels below decks, the new vessel has a maximum cruising range of 1,000 miles, so that extensive fishing and pleasure cruises may now be planned without the necessity of keeping such a close watch on tank gauges. In answer to one of the first questions which most prospective Diesel yachtsmen ask, there are no fuel oil fumes nor exhaust odors noticeable even at her top speed of over twenty miles per hour.

With twin screws and twin rudders the *OIO* maneuvers perfectly in the most restricted waters and crowded harbors and the instant response of the two Diesels to the remote pilothouse controls enables the helmsman to cope with any emergency which might arise while under way. The comfort of the owner and his guests is assured by the quiet engine operation and as additional precautions are the two standard Elco features: a soundproof engine room and suspension type rubber engine mountings.

From an economy standpoint, this new addition to the Elco fleet is equal to similar Diesel powered craft bearing that well known name. Cruising at 14 mph. and using fuel oil at 6 cents a gallon, the *OIO* costs approximately 48

The Diesel yacht "OIO," Mr. Waterhouse's third Elco, being hoisted aboard the "Steel Scientist" of the Isthmian Line, which will deliver her in Honolulu on or about January 1st.

cents an hour to operate. In other words, the actual fuel expense is less than 3½ cents per mile, so that the owner will spend more for railroad fare than he will for yacht fuel.

While the inherent design of the cruiser gives her an exceptionally low, rakish appearance, there has been no sacrifice in visibility either for the helmsman or for guests, and the interior arrangement utilizes space so effectively that eight persons can be accommodated over night in perfect comfort. Counting the spacious deck lounge with its latest refinements, makes her a two-cabin boat with lavatory and galley between and equally accessible from both cabins.

In powering his new craft, Mr. Waterhouse chose Buda Diesels rated at 100 hp. at 2,000 rpm. On eight trial runs over the Elco measured mile (with and against tide), these engines drove the boat fully loaded at an average sped of 19.9 mph. Reversing is accomplished by means of a Joes gear. The entire drive installation is notably quiet, free from vibration and unusually accessible for customary overhauls.

These Buda Diesels are unusually compact and trim in appearance and represent a high degree of development in small size, full Diesel design. They are of the solid injection, four-stroke cycle type, requiring practically the same hull space as a gasoline engine of the same power. Despite their clean-cut exterior lines, strength and ruggedness have not been neglected, and they stand ready to deliver smooth, safe, economical power under any and all circumstances.

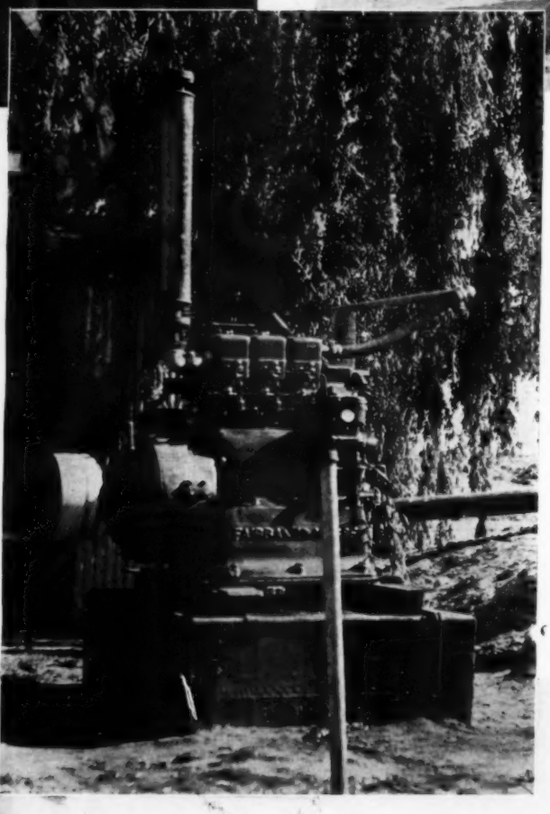
The marine Diesels in the *OIO* epitomize the solution to the modern 1936 yacht and smaller pleasure boat power problem. It is a tribute to the years of engineering research by Buda and other Diesel manufacturers that they can now offer dependable, light-weight, high-speed Diesels for this type and size of vessel and, in doing so, offer to yachtsmen the attendant economy and peace of mind regarding engine room fire and bilge gas explosion which have been all to frequent during the past year.

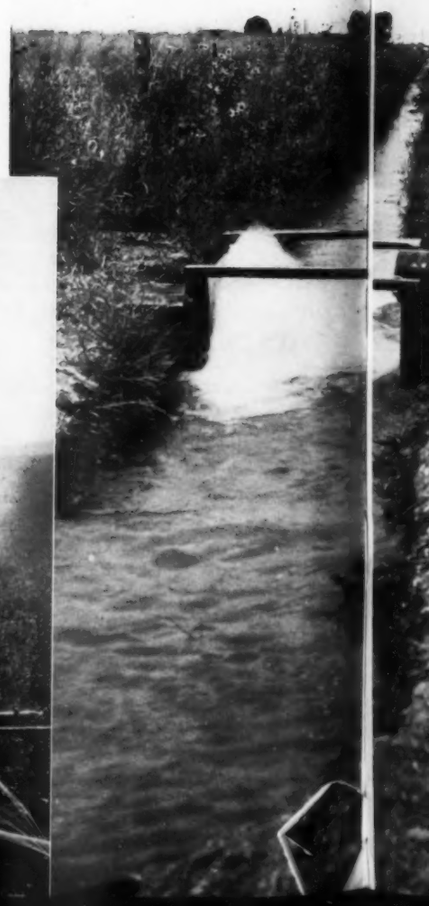
Top — The "OIO" en route under her own power from Bayonne to Brooklyn to be loaded for shipment.
Right — Galley.
Bottom — Looking forward from the after deck to the helm.

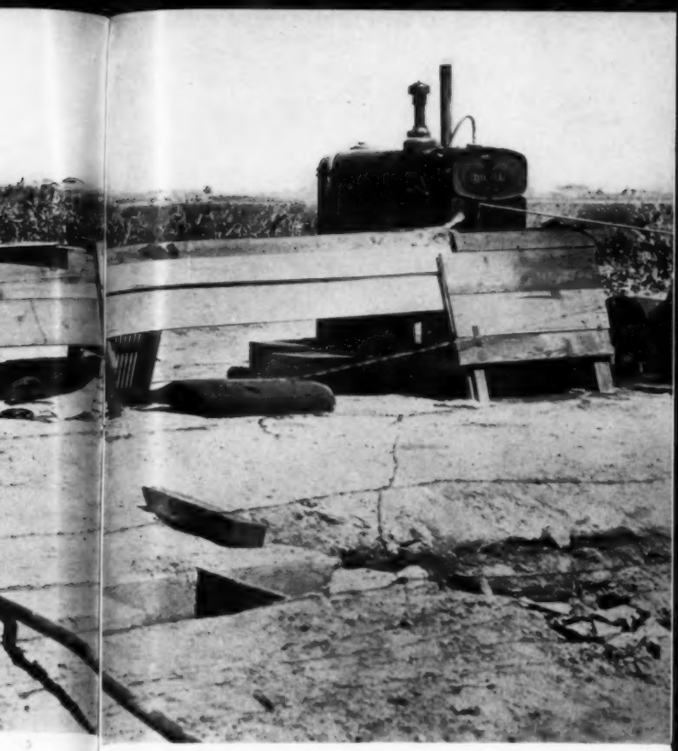
In Corcoran, California, Forest Riley saves money by the use of three of these Diesel units replacing direct connected electric motors which formerly pumped the irrigation water. The power is transmitted by use of quarter-turn flat belts. With these Mr. Riley has eliminated the expense of standby charges.

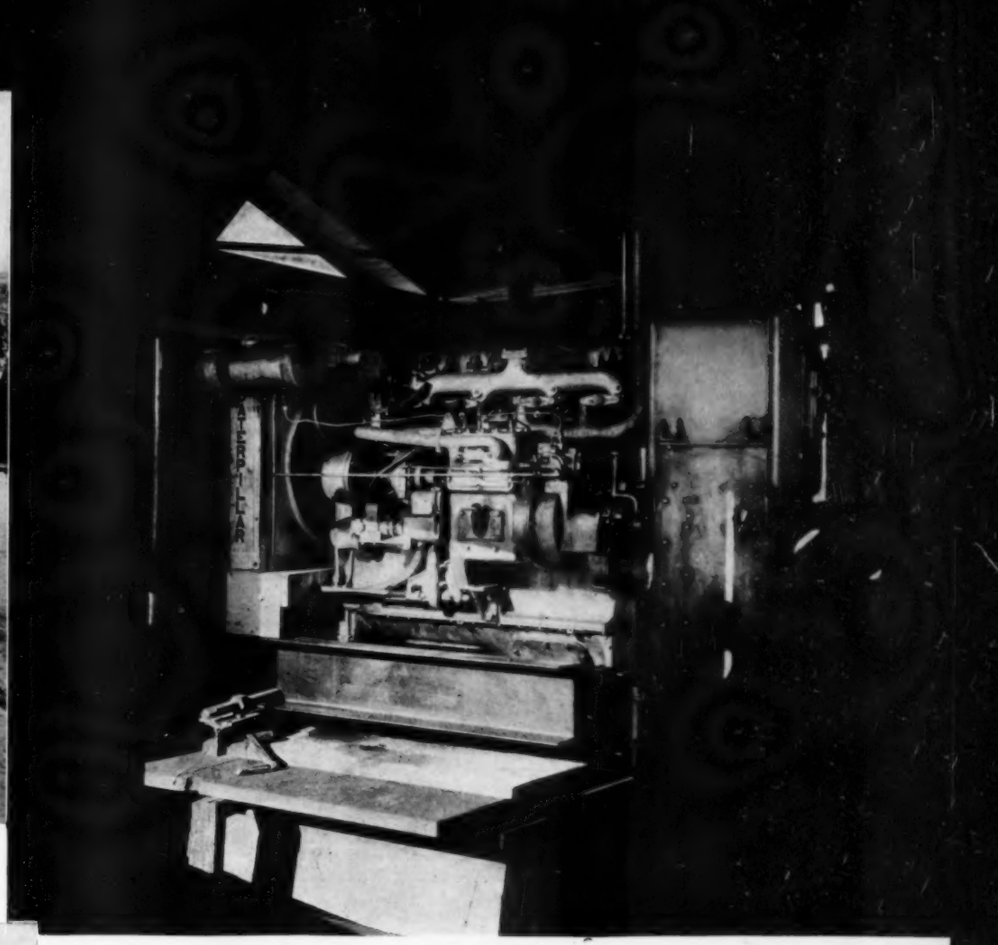
So efficient was the performance of a Model 36 three-cylinder Fairbanks-Morse Diesel on the farm of Mr. Pete Ciaberri in Southern California, that he bought a second one, shown at the right. The two engines together show a saving of $1,250 a year over purchased power.

Overhead irrigation of such crops as peas, sugar beets, other vegetables and fruits has been given new life in Western agricultural regions since the advent of the Diesel. Besides doing heavy field work, the tractors, hooked in pairs, save money and time when used as mobile pumping units.









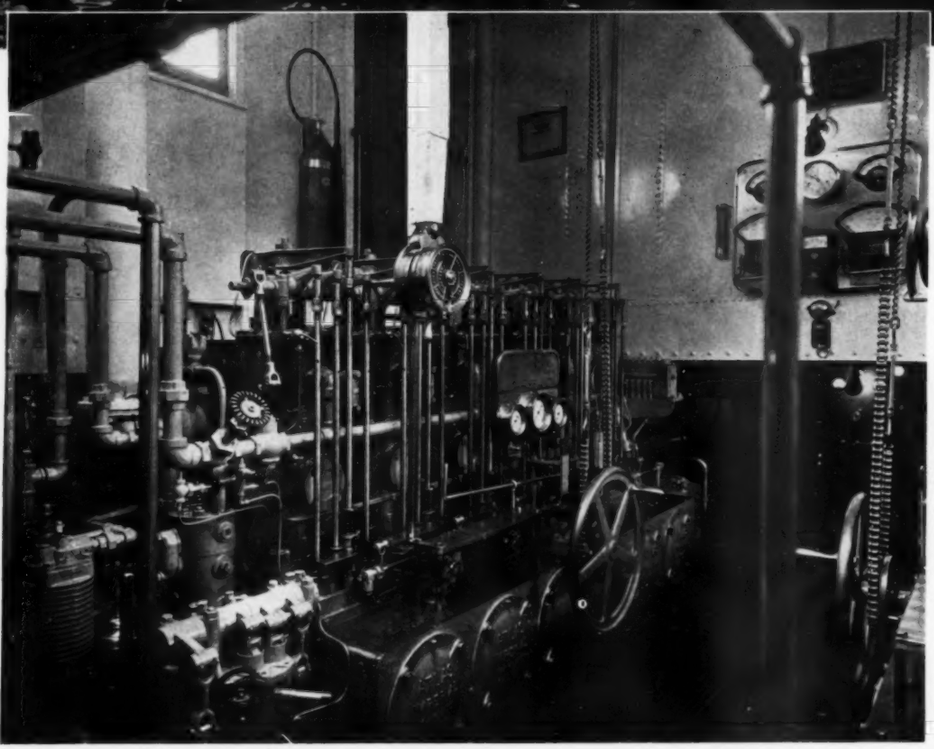
Running night and day, and in operation 1,900 hours when its operating costs were computed, this Caterpillar unit, driving a Layne-Bowler pump at 1,980 rpm., pumps 200 gpm. at a fuel and lube oil cost of 20 cents an hour. Electricity, formerly used for this water pumping job, cost 55 cents an hour.

Top Center—when heat and drought records began hitting all-time highs in 1934, several Colorado farmers found the answer to their water problems by installing Diesels. This McCormick-Deering outfit is owned by Charles Carder of Keensburg, Col. Crops were withering when the Diesel was purchased. Then the owner began pumping 800 gpm. into his half section and that of his father's farm adjoining. Beets went to 10 tons to the acre and alfalfa 1½ tons, as against a complete failure the year previous. Operating cost, 20 cents an hour.

At the left is another McCormick-Deering Diesel operating a turbine pump on the farm of Howard W. Macy, of Center, in the San Luis Valley section of Southern Colorado. It pumps water at a rate of 1,600 gpm. and is used to irrigate 140 acres of potatoes, the main crop in that section.

DIESELS IN IRRIGATION WORK

United States Lighthouse tender "Rhododendron" launched March 16, 1935, at Portland, Oregon, for operation between the mouth of the Columbia River at Astoria, Oregon, and the upper Columbia and Willamette Rivers.



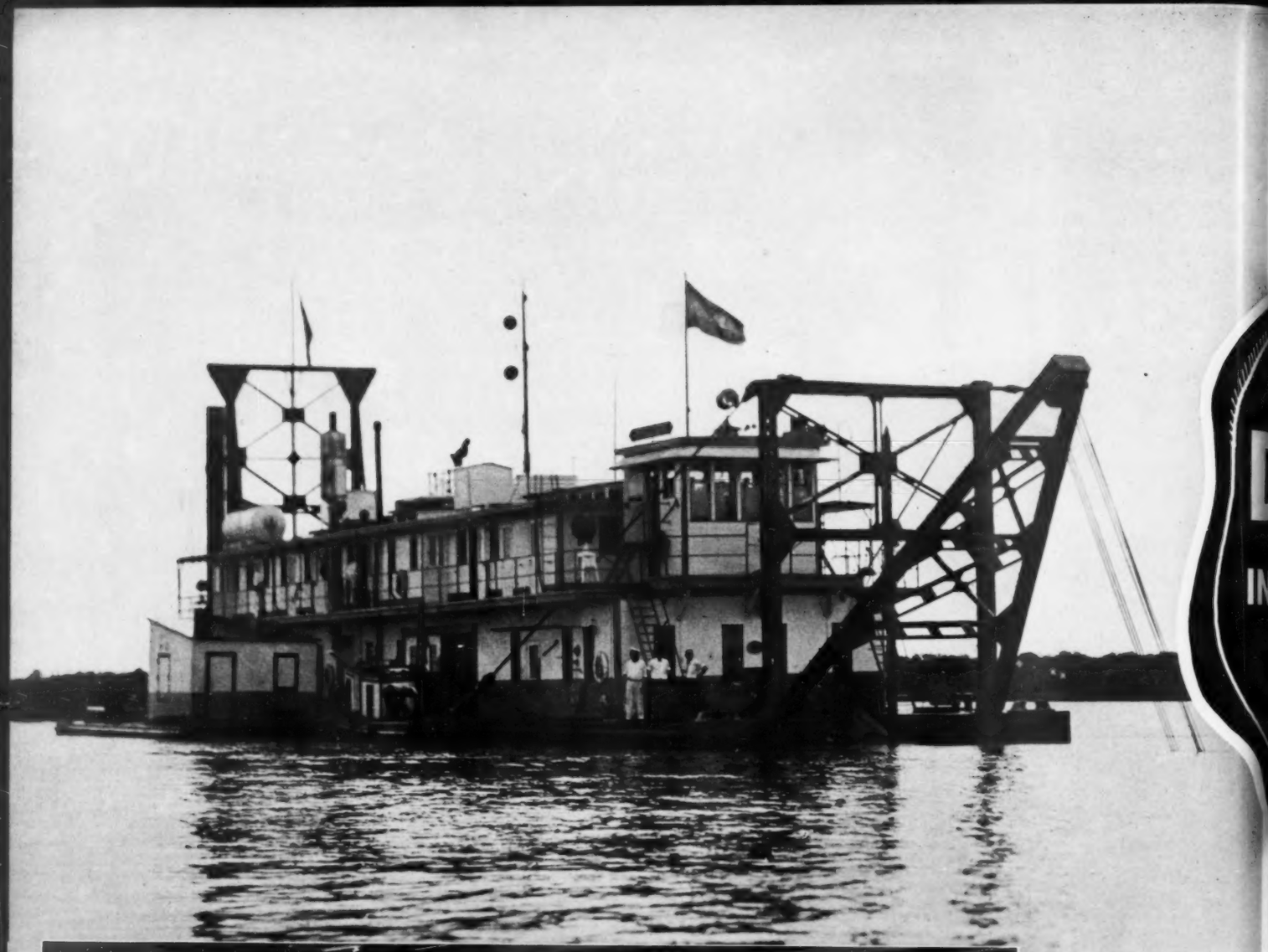
Engine room of the "Rhododendron" which contains two 120 hp. Atlas Imperial Diesel engines and a 10 kw. Hill Diesel generating set as an auxiliary power plant. Mounted on the instrument board are Weston tachometers and an Alnor pyrometer.

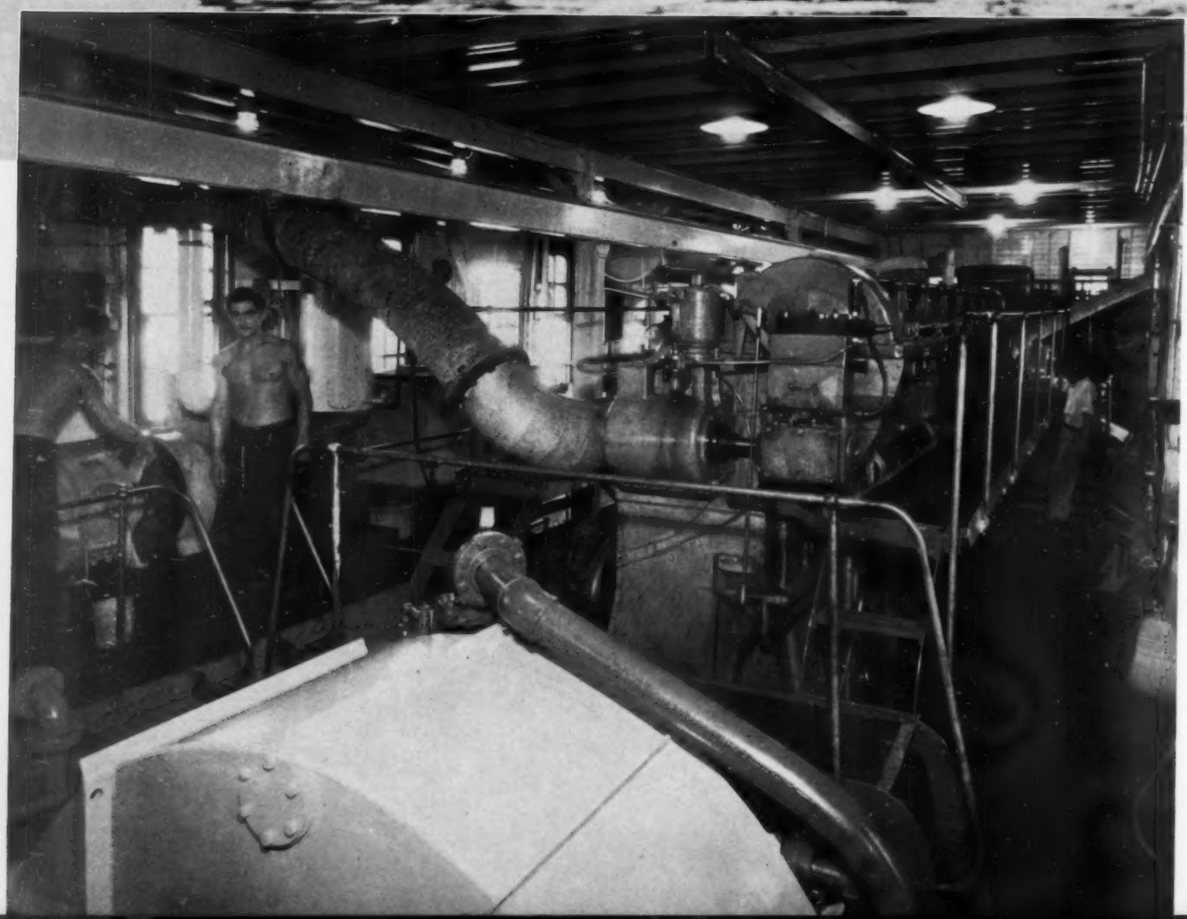
LIGHTHOUSE TENDER "RHODODENDRON"

POWERED by a pair of 120 hp. Atlas Imperial Diesel engines with a 10 kw. Hill Diesel generating set as an auxiliary power plant, the *Rhododendron* is the first twin screw, tunnel type tender to be constructed for the Lighthouse Service. Built by the Commercial Iron Works of Portland according to plans prepared under the direction of R. R. Tinkham, Superintendent of the Seventeenth District, this vessel represents the last word in steel constructed craft.

Designed specifically for inside service on the Willamette and Columbia Rivers, the *Rhododendron* has an overall length of 80′ 6½″, molded beam of 19′ with 6′ depth of hold. When loaded she has a draft of only 3′ 10″ and makes a speed of 11 miles. The equipment of the *Rhododendron* is very complete and this is especially true of the instrument board which can be seen in the right-hand column of the engine room illustration. On this board may be noticed two Weston tachometers which automatically record the rpm of each engine, and under them partly obscured by the post, is the Alnor pyrometer which records the exhaust temperatures on all twelve cylinders.

In her work of servicing the many navigation lights and channel markers on the Willamette River from its junction with the Columbia to Salem, Oregon, and from the mouth of the Columbia at the Pacific Ocean three hundred miles inland to Umatilla, Oregon, the *Rhododendron* encounters all kinds of river navigating problems due to the many swift currents and shallow bars on the upper Columbia River. Her twin screw flexible power plant and special design make her very easy to maneuver.





Showing general arrangement of engine room in Dredge *Pullen*

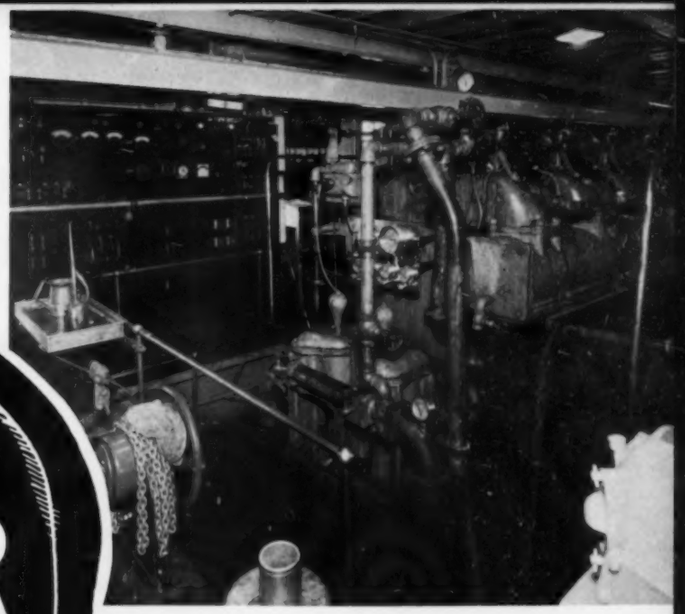
WINTON
CLEVELAND

WINTON DIESEL POWER

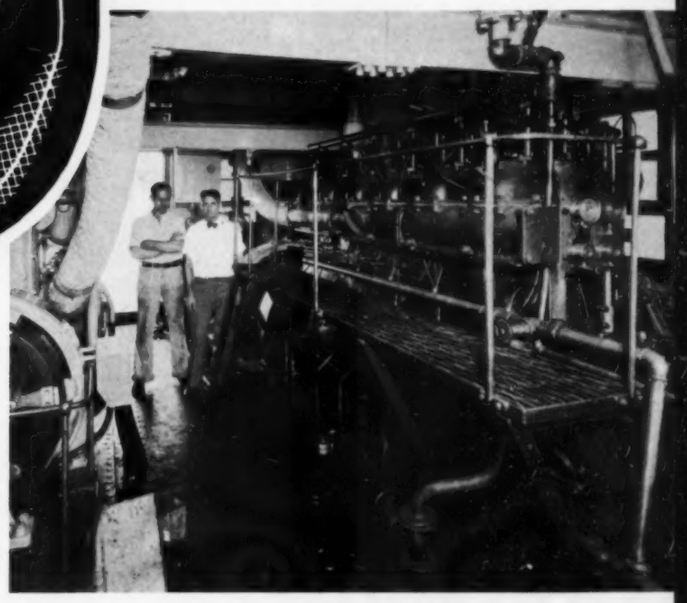
IN MODERNIZED U. S. DREDGE *PULLEN*

WINS SEAL OF APPROVAL BY

Lowering Operating Costs



Model 8-174A, 865 h.p. at 250 r.p.m., Winton-Diesel Engine recently installed in Dredge *Pullen*. Instrument panel in background



Above: Model 116, 150 k. w. at 350 r. p. m., Winton-Diesel Generator Set, converted to airless injection

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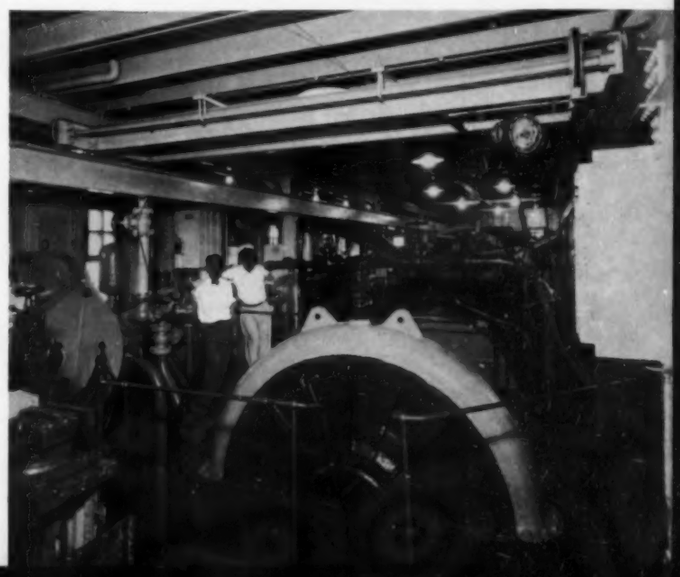
Below: Showing dredge pump and hydraulic coupling in foreground



THE U. S. pipe-line dredge *Pullen*, constructed in 1926, is a "non-propelled" oil engine dredge 130 feet long, 33 feet beam, and 8 feet deep, with a displacement for 600 tons. The ladder is 50 feet long and is of I-beam and castings construction. The dredge has an 18-inch suction, 15-inch discharge, is capable of digging from flotation to a depth of 40 feet, and has a maximum swing of 300 feet. Upon completion, it was placed in service on harbor project work in the Norfolk, Virginia, U. S. Engineer District, later being transferred to Florida for Intracoastal Waterway service. In 1933 the *Pullen* was assigned to the St. Johns River to maintain project depth. During this latter period of service it was decided that modernization of its power plant would greatly increase the *Pullen's* efficiency and permit more economical operation. Modernized in 1935 with Winton power, the installation included a solid-injection-type, 865 h.p. Winton-Diesel engine fitted with hydraulic coupling. Resumption of operations with the new Winton-Diesel engine revealed that efficiency and output had been greatly increased. The former maximum length of pipe-line that the dredge could operate was 2,500 feet. Now the dredge is operating on a 5,000-foot pipe-line and is dredging more efficiently than was possible with the 2500-foot pipe-line. Comparative costs of operation develop the fact that the selection of a solid-injection-type Winton-Diesel engine for the *Pullen* represents a sound investment . . . a logical sequence of all Winton-Diesel installations.

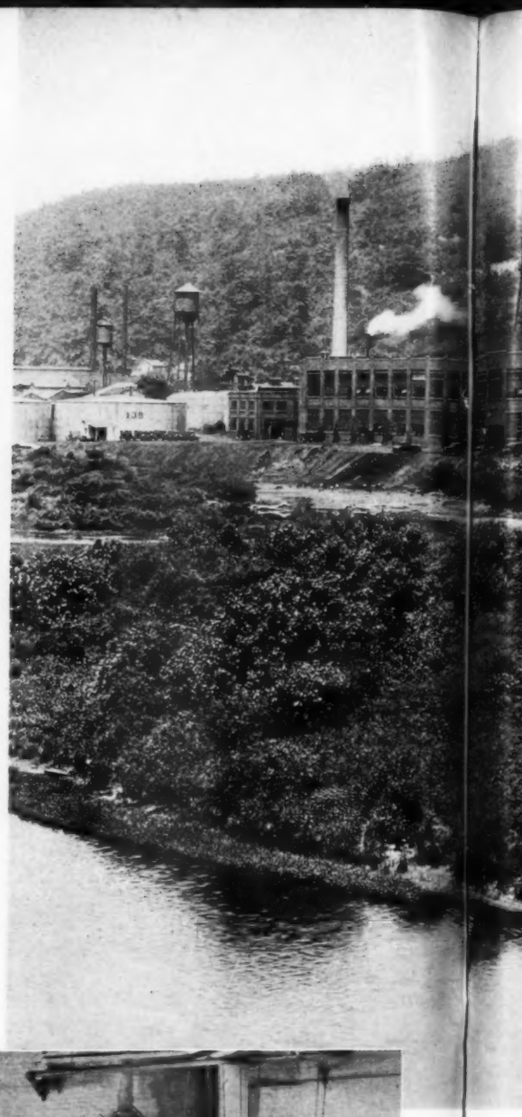
Symbol of Economy and Dependability

ENGINE CORPORATION

OHIO · U. S. A.

A DOCTOR TAKES HIS OWN MEDICINE

Chicago Pneumatic's Diesel Power Plant



WHEN the Chicago Pneumatic Tool Company state that Diesel power can generate a kilowatt hour well under one cent, they know from actual operation of their engines that this is possible, because for fifteen years this company has used Diesel power for the operation of its compressor and engine plant located at Franklin, Pa.

Their present power plant was built in 1920, and the equipment then consisted of two horizontal, duplex, semi-Diesel (A-DO) units, and two Skinner Unaflow, steam units, all connected to dc. generators. For eight years these units successfully served the needs of the plant, until 1928, when the company expanded considerably and one of the most modern cast iron foundries in that section of the state was built, which housed five new cranes and added a considerable load to that already carried by the A-DO units. It was then decided to replace the semi-Diesel and steam units with full Diesels.

In determining the suitability of Diesels to produce electric current, considerable study of the plant conditions was involved. Fifteen cranes having a total lifting capacity of 161 tons are located around the plant. The current required by these cranes in general depends upon the weight of the piece being lifted, but when five or six cranes are each lifting a heavy load, a surge in the current required is placed upon the system. Besides these surges, the power plant must carry, for 24-hour service, a rather constant load consisting of lights, line-shaft motors, and incidental equipment throughout the plant. Load diagrams were secured by the installation of recording meters in the power plant and the load factor secured.

In June of 1928, the first unit was installed (Fig. 1), in August, 1929, a second Diesel unit was added, and in May, 1931, an additional 4-cylinder Diesel, 160 hp. at 327 rpm., connected to a 100 kw. dc. generator, was placed in service.

Many interesting and automatic contrivances attached to this installation for the economy of operation, quietness, and all-round performance make it a unique plant. The fuel system is completely automatic. Located in the basement of the power plant is one 15,000 gallon fuel storage tank. Fuel oil, from the tank car, is drained into this tank and from here it is pumped by Viking pumps into two 1,000 gallon day tanks. A Mercoid pressure-control switch makes the system operate automatically and as soon as the fuel level in the day tanks

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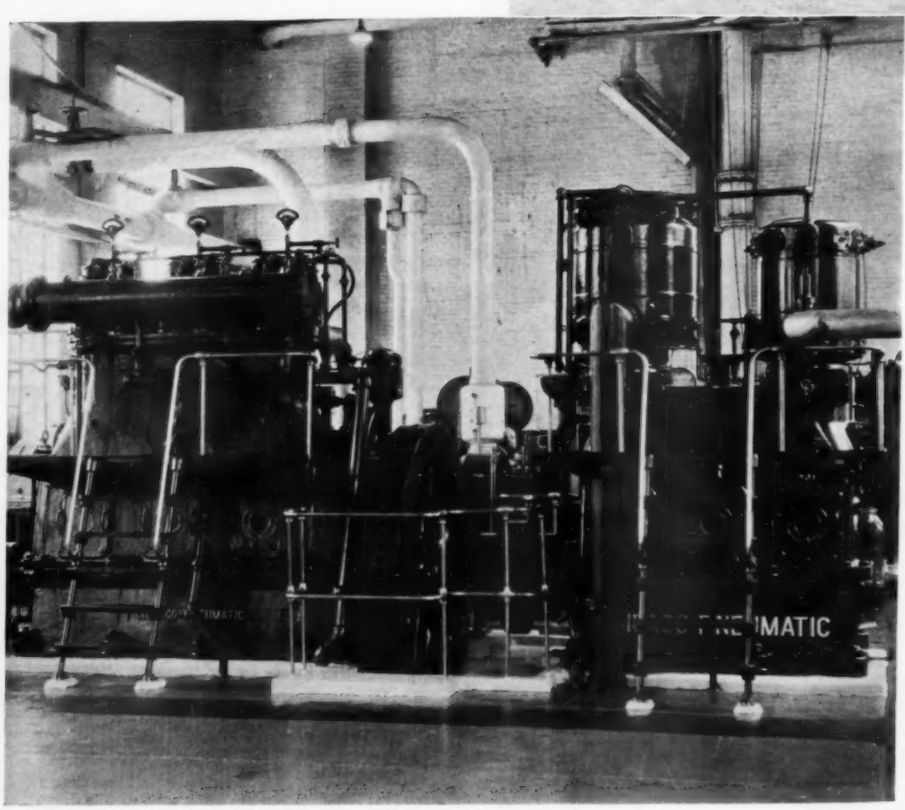
Fig. 4 — A 225 hp. at 247 rpm. C.P. Diesel directly connected to a 20 - 12 x 14 C.P. vertical, two-stage compressor.



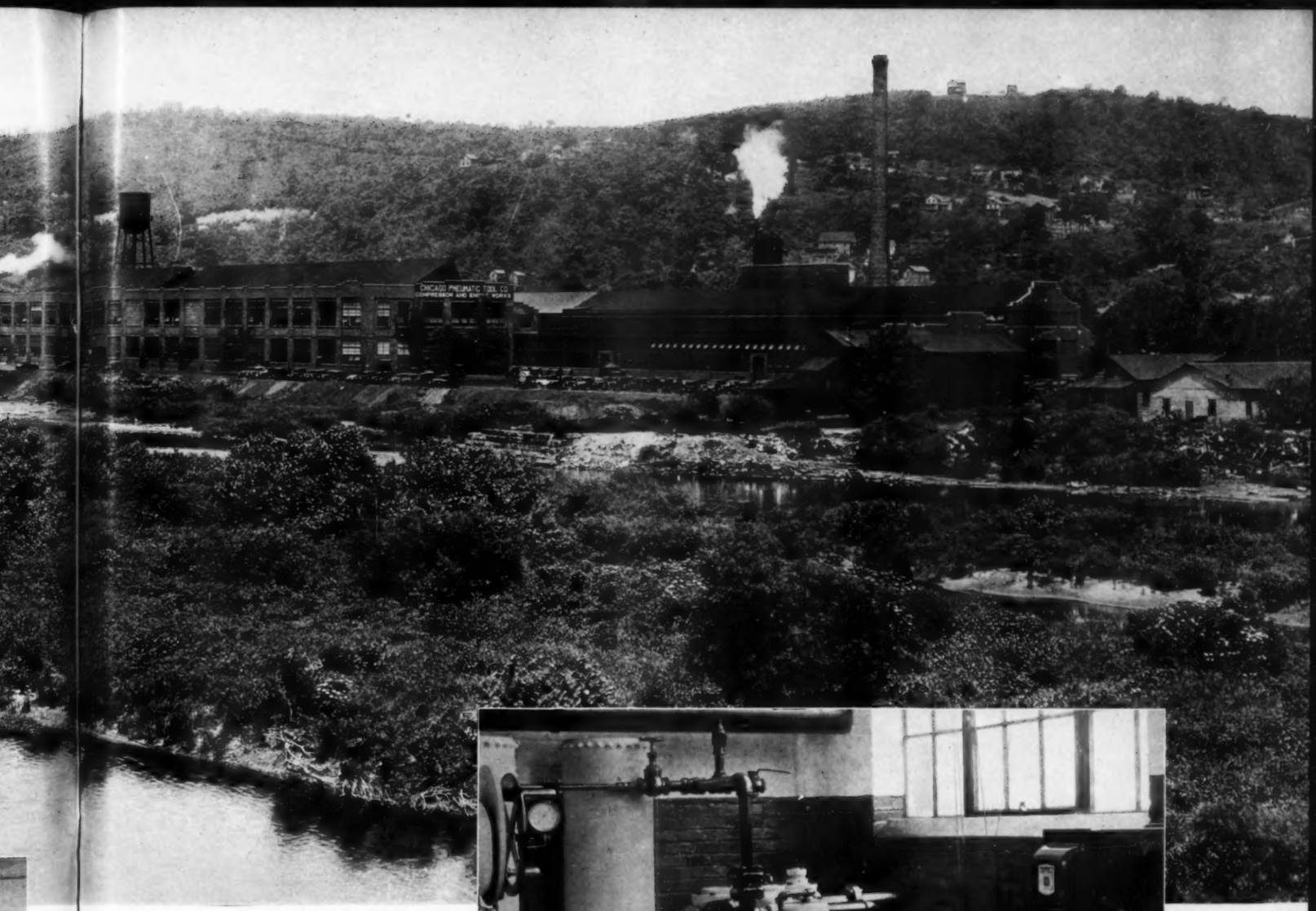
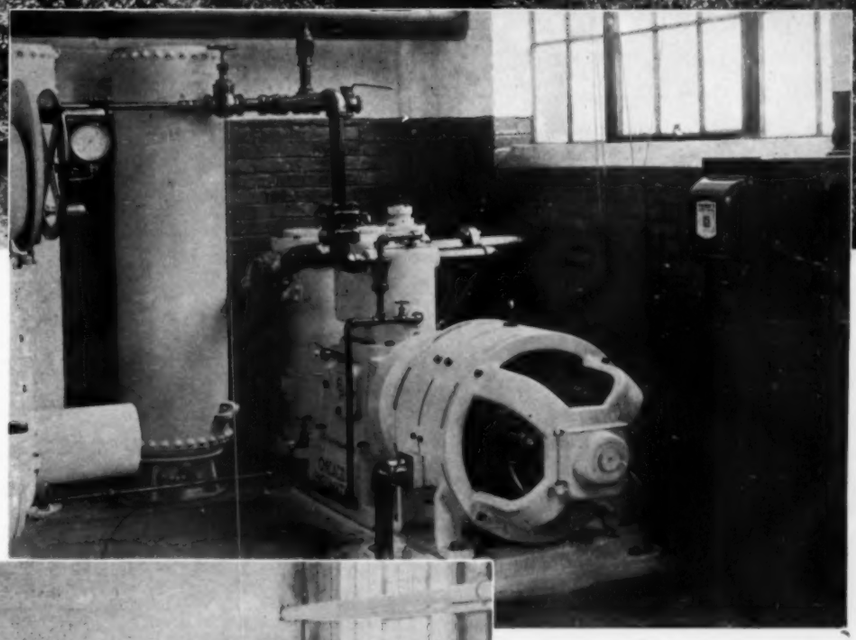
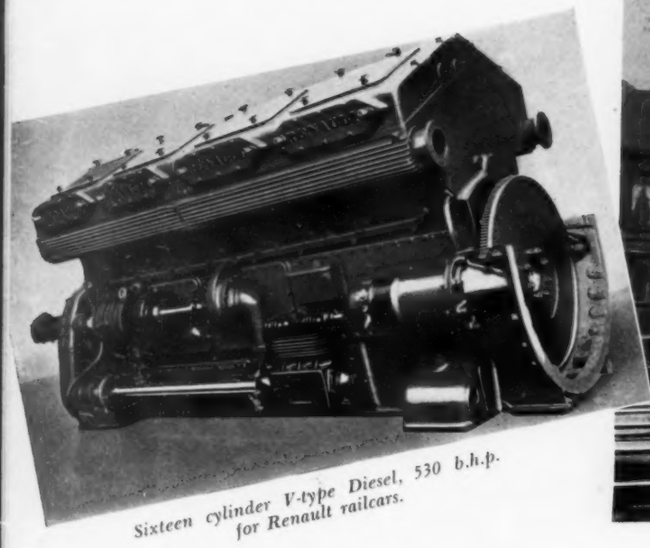


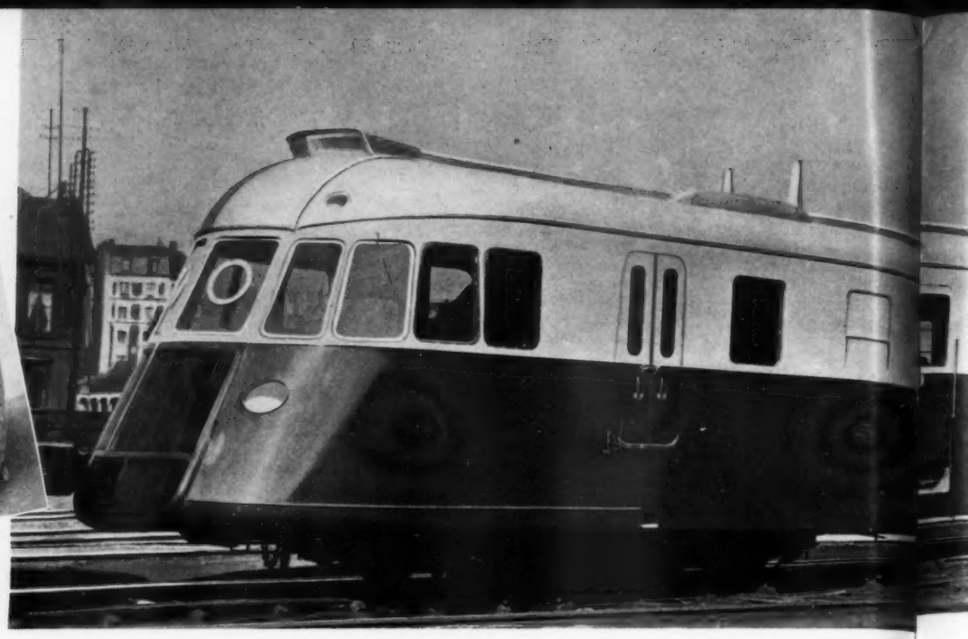
Fig. 2 – The Chicago Pneumatic Plant at Franklin, Pennsylvania, showing French Creek which is used as a water supply.



Upper – Fig. 3 – The automatic air starting unit and starting air tanks. Left – Fig. 1 – Two 450 hp., each at 257 rpm., C.P. Diesels; the unit in the foreground is the second unit installed.



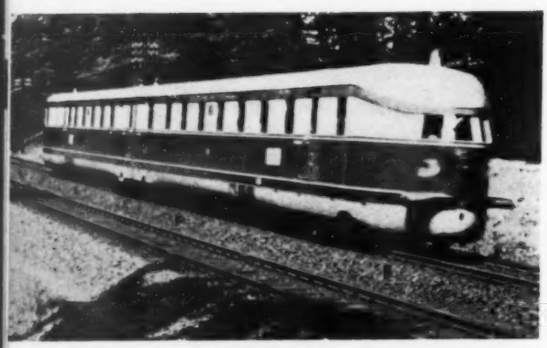
Sixteen cylinder V-type Diesel, 530 b.h.p. for Renault railcars.



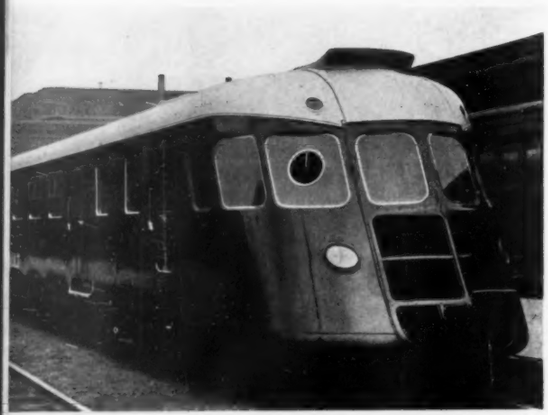
LONDON LETTER

European Rail-Car Developments

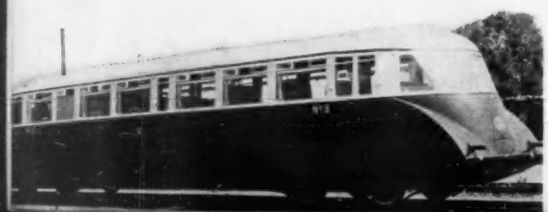
By GEORGE LIND



The "Flying Hamburger."



Single coach, 265 b.h.p. railcar made by Renault.



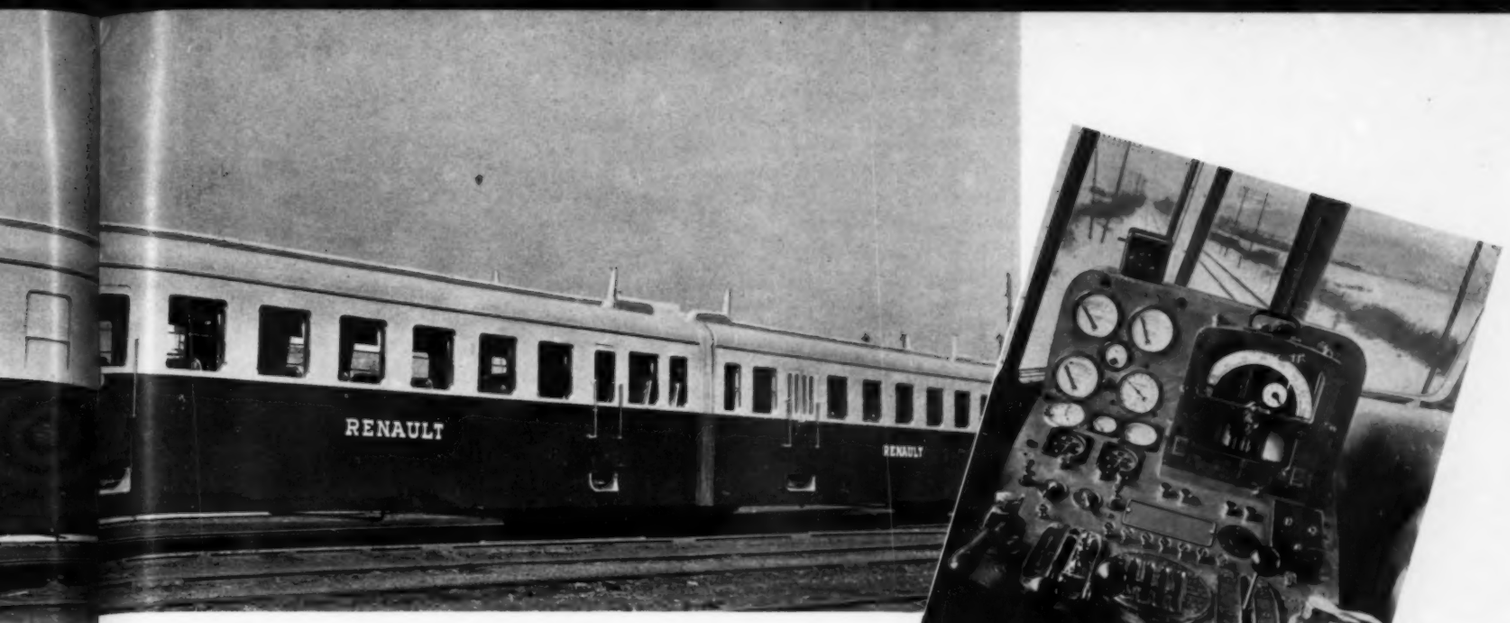
A.E.C. single coach railcar.

TODAY the leading European country for oil-engined rail service is without question Germany. The German State Railways now operate some 250 railcars, whilst outstanding orders account for at least another 100. Of the present cars in service, 40 are streamlined cars of two and three sections with carrying capacities of 100 and 140 passengers and speeds of 90 to 100 m.p.h.

There are six long distance services with average speeds of well over 60 m.p.h. now in operation in Germany. These are between Berlin and Hanover, Hamm and Hanover, Berlin and Hamburg, Berlin and Cologne at average speeds of 72.7 m.p.h.; between Berlin and Frankfurt (a distance of 350 miles) at 67.4 m.p.h. and Berlin and Halle at 66.2 m.p.h. In all cases, stretches have to be covered at more than 90 m.p.h. and the "Cologne Flier," one of the latest 3 coach units, reaches and maintains a speed of 100 m.p.h. between Hanover and Berlin.

The first oil-engined passenger train operated by the German Railways, now famous throughout the world as the "Flying Hamburger," completed its 1000th run between Berlin and Hamburg on April 30, 1935. This car, the model from which all later models have been developed, has covered 201,250 miles since its inaugural run 2 years ago, carrying in that time over 100,000 passengers. It has been allowed 5 days out of every 100 for overhaul and maintenance, which gives it an operative efficiency of 85 per cent, or roughly 6 per cent more than that of a steam engine.

The original German railcars of the "Flying Hamburger" class are powered with two V 12 Diesel engines of 410 b.h.p. each, built by the Maybach Zeppelin Company. Diesel-electric transmission is employed, the engines being located on the two end bogies, with the two control boards directly above. The interior arrangements consist of a main passenger space, divided into 2nd class 8 seater compartments, a very attractively appointed snack bar and a large baggage store. In the recently completed three coach designs, 2nd and 3rd class accommodation is provided, whilst the power output has been increased to 1,200 b.h.p. Either Maybach, M.A.N. or Mercedes 600 b.h.p. V 12



530 b.h.p. twin engine Renault railcar for use on the Northern Railway of France.

Above—Controls of a Renault twin-coach railcar.

Diesels are fitted, the two first mentioned being supercharged. An interesting point about the Maybach engine is that despite the higher output the fuel consumption is fully 10 per cent less than for the 410 b.h.p. power unit.

If Germany is the leader in European railcar development, France is certainly a very close second. The benefits of greater speed, cheaper and simpler maintenance and lower running costs appeal very much to the economizing Frenchmen of 1935 and to the present total of some 240 railcars the French railways intend adding another 250 during 1936.

Here are some running costs for the past 18 months as estimated by the State Railway:

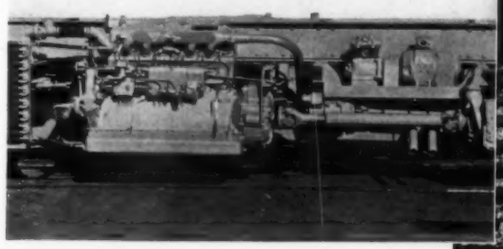
Running cost per kilometre. Suburban Service.

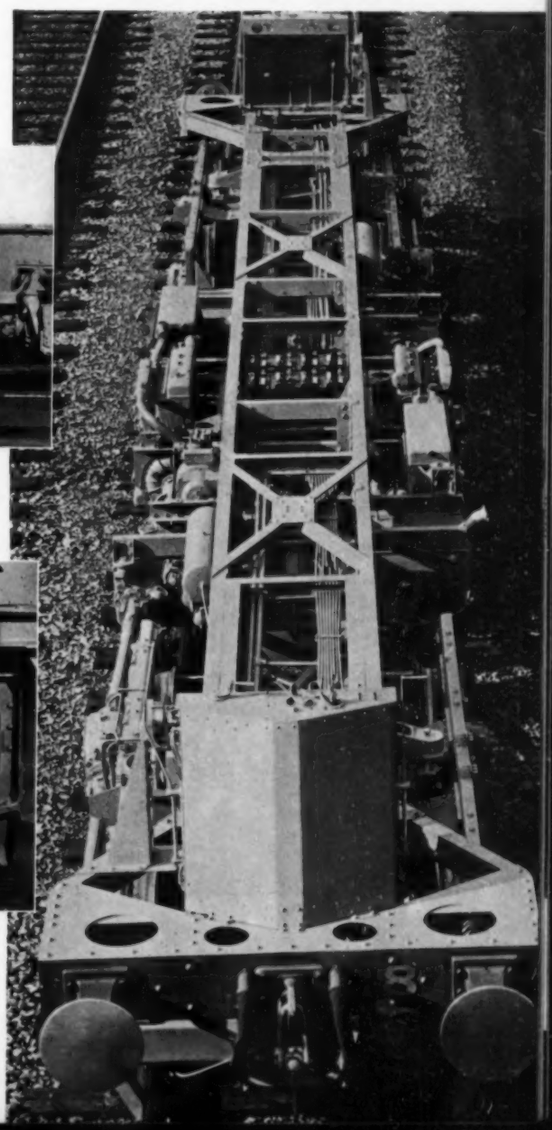
Average steam train of 7 passenger coaches ..... 9 fr. 25 c.

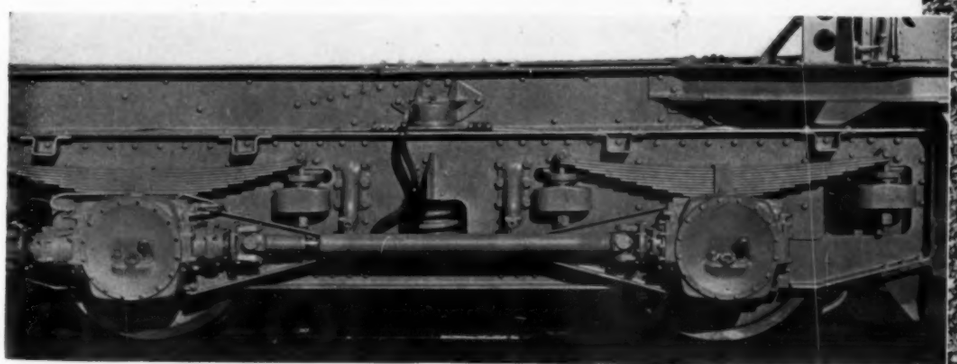
Oil engined railcar equivalent. (2 three car units) ..... 8 fr. 35 c.

At the moment many different types of railcar are running about on the French tracks, but

Below—Driving unit of A.E.C. single-coach railcar. To the right—Layout of A.E.C. single coach railcar chassis.







Axle box drive of A.E.C. single-coach railcar.

gradually opinion has turned in favor of the 80 to 100 seater train coach unit, the power output of which is about 500 b.h.p.

Of this type easily the most popular is the Renault A.B.V. Automotrice, fitted with two 265 b.h.p. V 12 Diesels. The engines are fixed to the main car chassis and drive through a purely mechanical transmission to all 4 bogie wheels. The weight of the whole assembly, complete with a complement of 100 passengers, is 65 tons, its maximum speed being slightly over 90 m.p.h.

Another type of railcar much used in France is the 110 b.h.p. shuttle service car. This has seating for 40 passengers and its main duty is to deliver newspapers to the outlying suburbs of Paris and help in relieving the rush hour traffic. Seven or eight cars are stationed at each terminus and in the early hours of the morning they journey to and fro delivering the bundles of newspapers. Later on when the morning rush begins they again become active, picking up city workers and collecting the unsold news sheets.

Apart from Germany and France, Denmark and Italy are the most active experimenters with Diesel powered trains in Europe at present.

The Danish State Railways have over 180 oil-engined locos and railcars, designed and built in the Frichs works at Aarhus. Their newest production is a 75 m.p.h. 1100 b.h.p. railcar for main line traffic. This is a four engined three coach machine with moderate streamlining and Diesel-electric transmission.

Italy is also busy engaged in Dieselizing her main line services, but owing to the Abyssinian war exact details are difficult to obtain. The Fiat Company of Turin are the builders of nearly all the Italian railcars.

So finally we come to Great Britain, the most backward of all European countries, as far as Diesel trains are concerned. Up to the present there is not a single multi coach railcar running in the United Kingdom and the total number of single car units is a little over a score. The general apathy and lack of interest seem thoroughly out of place when one considers that Britishers have been complaining for years now of their bad train services.

The railcars that are in existence, at any rate, are proving highly satisfactory and for branch line connections the railway companies are relying more and more upon oil power.

One of the most recent repeat orders was for 10 A.E.C.-Hardy 40 seater single coach units for use on the Great Western Railway. The first machine of this type was delivered in 1934 and since then 6 more have been added. The latest models contain a number of improvements, not the least of which is an increase in riding comfort.

For the motive power two 130 b.h.p. A.E.C. Comet engines are slung either side of the main chassis frame, exactly amidships. They face in opposite directions and drive all bogie wheels through a fluid flywheel and 5 speed epicyclic gearbox. An interesting feature is the incorporation of the final drive in the axle boxes. Just in front of the engines are the radiators and farther forward still the fuel tanks. The advantages of this outside location are said to be:

Fully sprung driving units.

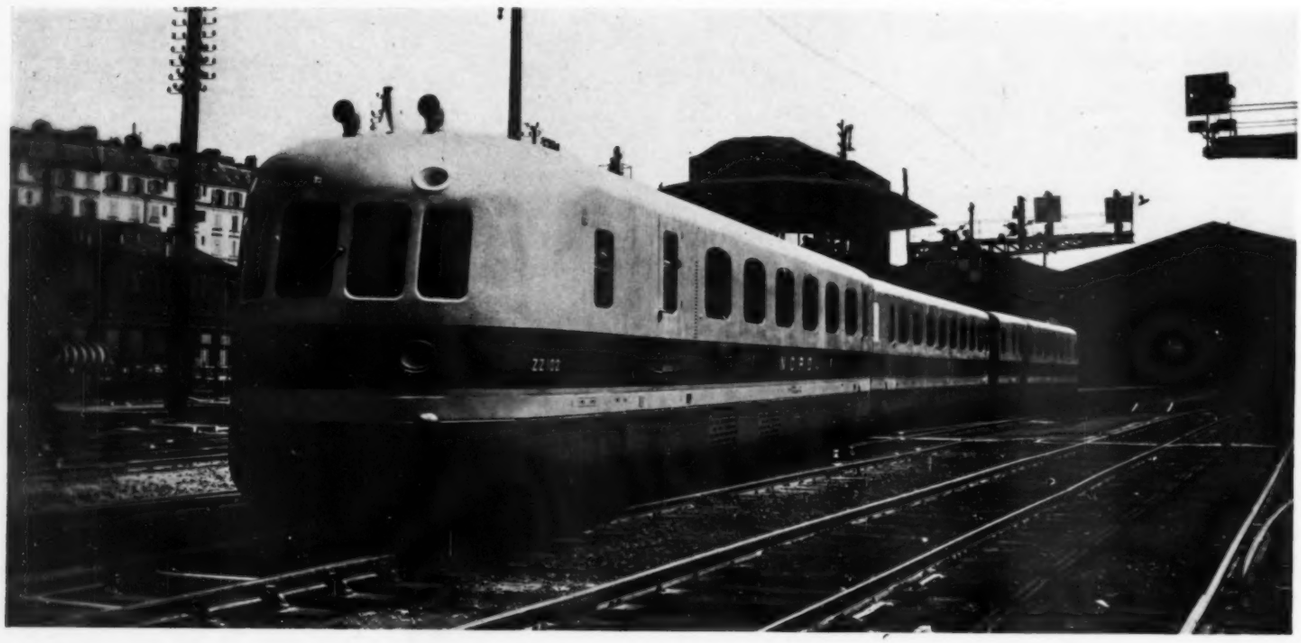
Driving mechanism can be kept below floor level.

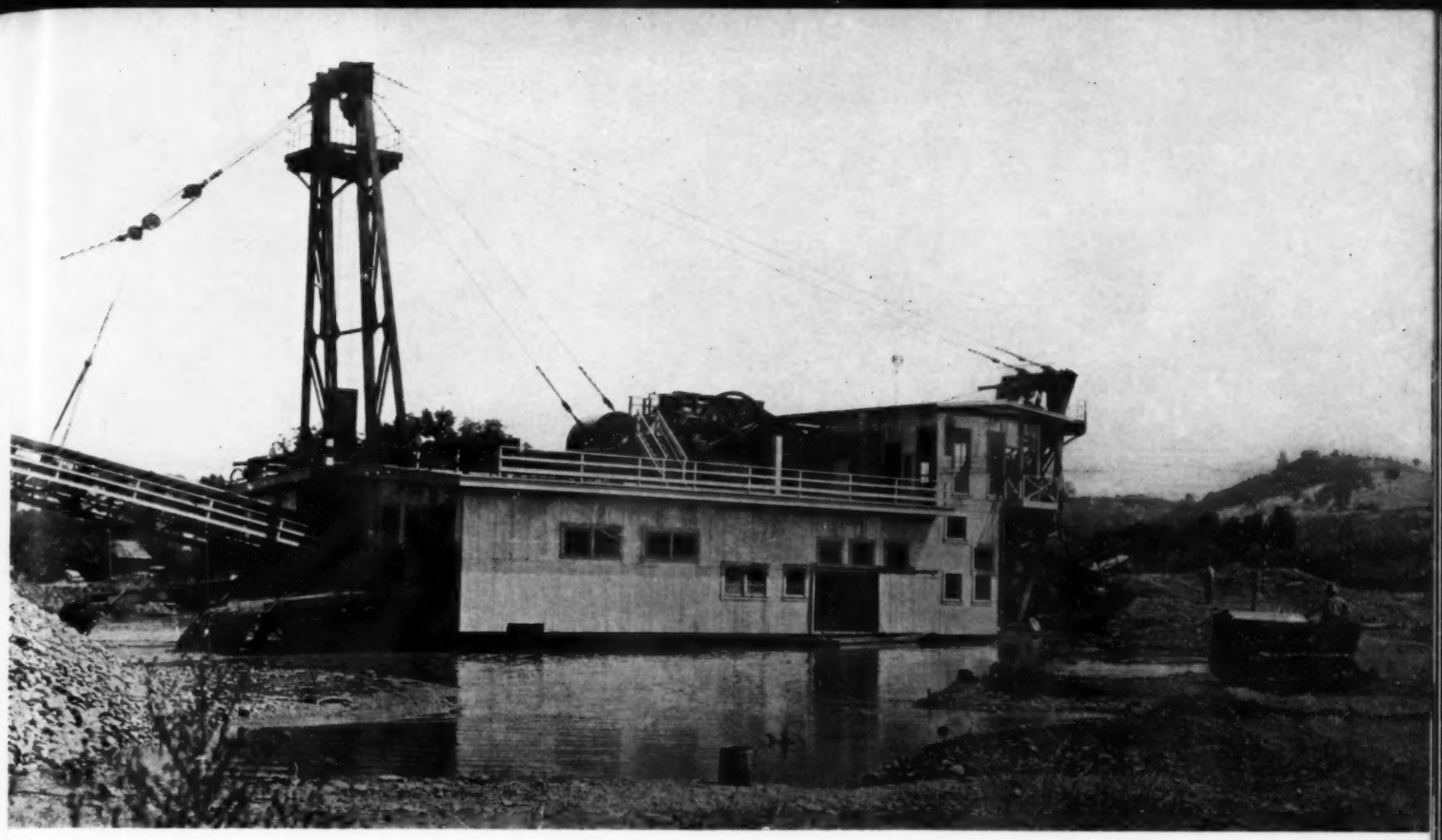
More space is provided inside the car.

Although they are not designed for express traffic these A.E.C. coaches are quite fast and in one case the 77½ miles from Swindon to London was covered in 70 minutes, giving a start to stop speed of 66 m.p.h. The running costs are very satisfactory, too, and allowing for wages, depreciation, fuel, lubrication and maintenance the average figure is 12 to 13 cents per mile.

This, then, is the only type of railcar so far developed in England. It looks rather as though we should have to run hard to catch up with our American and European contemporaries in this branch of oil engine application!

Diesel Railcar built for the Chemin de Fer du Nord of France by the Maybach Company. Speed 100 mph. Powered with two V-12 Diesels of 410 hp. Seats 30 first class and 114 second class.





Just out of Comanche, on the Mokelumne river, we found this new gold dredge starting to burrow some thirty feet into the river's bed for Nature's hidden gold. The Allis-Chalmers oil tractor is furnishing the power to pull this great $100,000 gold digger forward by means of the cables running from the front end on each side through tackle blocks. Thus the dredge is steered to right and left and forward as the banks are eaten away by the chain of revolving buckets that carry the gravel and mud into the bowels of the dredge for washing and shaking out the loose flakes and nuggets of gold before passing the material back to the stack in the rear.

DIESEL GOLD DIGGERS

By F. HAL HIGGINS

THE ghost towns of the gold miners are stirring with real life again. Grandsons of the '49-ers, sons of the Klondyke sourdoughs, every man who ever had anything to do with past gold mining projects anywhere, and new gold-hungry hordes who classify as mere greenhorns are gold digging in this year of 1935. The price of gold rates $35 an ounce.

The writer has just returned from a 5,000-mile drive, much of it through the gold strike areas of '49 and the '70's and '80's, on the west side of the Sierras and in Oregon and Washington. Not only are the old gold mining areas teeming with activity in the way of mining and reconditioning old abandoned mines and stream diggings, but everyone in the business could tell similar stories of activities in all the other areas he knows. Anyone without a gold mine of some kind doesn't seem to be in style. The same almost can be said of business and professional men in such cities as San Francisco, Los Angeles, Portland, Seattle, Sacramento, Spokane, Salt Lake City and smaller cities between.

But the one new note in the gold mining business seems to be the Diesel engine as power to permit the working of marginal projects that could not be worked by old-fashioned man power with pick and shovel, gasoline engines or electricity. I refer to the Diesel-powered dragline dredges especially.

It is strange, at first glance, that no one seems to have any definite idea as to the number of projects under way, the investment in new dredges, dragline outfits, stamp mills and other mining machinery. Even the gold production figures lag behind a year or two. Each equipment manufacturer knows in a general way, however, what has been bought for gold mining from his dealers and salesmen. California mining interests are trying to get a New Deal appropriation from Washington to get a census of the gold mining picture, but the competition from the Boon-doggling interests for such cash as may not be already tagged is very, very tough, they admit.

In our drive across the Mother Lode country, however, we did take time to see most of the big dredges that cost from $100,000 to $900,000 each, the latter said to be the largest in the world and capable of going down 120 or 130 feet in the stream beds in the search of free gold deposited by the stream through the ages. Where there was but one of these still working back in the lush business days of '28 and '29 and its owners figured it would be all through in another year's work with the price of gold at $20, all the old dredges have been re-assembled and put to work, and many new ones have

Diesel-motored truck leaving Big Canyon Mine, near Shingle Springs, in the Mother Lode country of California. This is claimed to be the most modern one of its kind in the state of California, being owned by a great British syndicate with mines in many parts of the world.

Over to the right is the 35-ton mill and compressor of the Imperial mine near Quincy, California, which is equipped with a 6-cylinder Cummins Diesel engine.

been added until there are at least thirty of them on streams in California and Oregon. Most of these big fellows are powered by electricity with from six to a dozen big motors in them, a field that the Diesel makers have apparently overlooked.

It is in the smaller dredging operations that the Diesel has established itself. A "Dragline Dredge Operation," the equipment lads call it. Says Claude M. Chaplin, publisher of *Mining and Industrial News*, "California and other gold states have witnessed within the past two years the development of the Dragline Dredge, applicable primarily to gold recovery from relatively small and shallow gold-bearing gravel deposits, which cannot be worked profitably by the large bucket-type dredge. A number of these operations are now being carried on, six plants being located in the Lincoln district of California. The combined ingenuity and resourcefulness of gold placer operators and machinery and equipment manufacturers have made possible profitable gold recovery in such areas."

Of course, the operators of these outfits know approximately what their diggings will run in free gold before they purchase and set up any outfit of this type almost as well as does the big concern that invests from $100,000 to $900,000 in a dredge that searches the old river bottom gravels and mud to a depth of from 30 to 125 feet – perhaps better. The dry stream beds are pock-marked with sample holes where the shovel and pan have done their work to prove sufficient color in the areas leased for dragline dredging. It's merely a business of turning over a great quantity of gravel per day, per month and per year. Every minute

Cumle & Ferris dredging operation showing the 40-hp. Fairbanks, Morse under the shed operating a pump which furnishes sufficient water to keep the barge floating on the pond down the river a mile. Mounted on this barge is a 34-B Bucyrus-Erie dragline powered with 122-hp. Atlas Diesel engine and a rotary screen which is powered by another 60-hp. Atlas Diesel.

is precious while gold remains at $35 an ounce; wide-spread depressions that bring gold up to such levels in price last only a comparatively short time. A drop of $5 to $10 an ounce throws many marginal areas out of consideration, and a return to the $20 normal would check off most of these operations immediately, of course. Hence, the 24-hour, 3-shift-per-day work one sees in gold mining. It's a job that works against the golden minutes as well as in search of the gold flakes and nuggets.

We saw Ferris and Cumle's high-pressure outfit on a dry stream bed near Clements, up from Stockton some 20 miles. Ferris is "Deep Hole Joe" of Klondyke days, and Cumle is "Frenchy," third generation of the '49 Cumle's who hit the California gold area right after the wars in Europe that turned so many ex-soldiers loose at a time when the world was gold hungry and young men were crowding ships to America and new opportunities. This pair of experienced gold hunters were tearing up the stream bed to a width of fifty yards and more, having traversed some two miles of it to a depth of fifteen feet since March 15, when they invested $11,000 in three new Diesel engines: a pair of Atlas Imperials of 120 and 90 hp. to run the 34-B Bucyrus-Erie dragline and the rotary screen, plus a 40 hp. Fairbanks-Morse for the Monarch pump to apply enough water to keep the dredge floating and the gravel washing as it progresses through the screen.

Mr. Cumle was on the job and readily talked about everything but how much gold he was taking out, which question is as bad manners to ask a gold miner who is really getting it as it is to quiz a Reno resident on what particular occupation he follows in relieving the "suckers" of their dough. "It's the same old principle of getting free gold our grandfathers followed, except that it is speeded up and cheapened in cost by multiplying our sixteen men by these three Diesel engines. Instead of, say, 3,000 men digging with picks and shovels and washing with pans, we work these men in three shifts around the clock to keep the engines and machines going every minute of the time except at clean-up periods now and then. In fact, we couldn't afford to work this marginal gravel here by old methods; the Diesels cut the costs to the point where they can be profitably worked when no other method would permit taking out gold here."

It takes about 125 gallons of Diesel fuel daily to run the three Diesels. As to the gas engine of 110 hp. used before Diesels were installed, Mr. Cumle said it burned 150 gallons of fifteen-

cent fuel daily. Diesel fuel is purchased for five cents.

The advantages of the Diesels for this type of gold mining, Mr. Cumle summarized:

More dirt moved per hp.
Fewer repairs
Less time out – more yards moved per day
Fuel saving of at least 80 per cent

We next drove north through the Mother Lode country made famous to the world by Mark Twain and Bret Harte, passing through Placerville or "Hangtown" to the '49ers who noted the swinging bodies of those whose activities overstepped the proprieties. On down the road we came to Jackass Hill and paused to inspect the old cabin of "Sam" Clements where he wrote "The Luck of Roaring Camp" while doing a little prospecting on his own. The parking of some hundreds of Missouri nightingales and the consequent night-long grand opera serenade that kept the miners awake gave the hill its name. The hill is once more alive with miners, all the old shacks seemingly inhabited with shafts being worked all around the old cabin of the author of "Huckleberry Finn."

The next morning, we went up the road from Sacramento through Folsom to Shingle Spring and turned off the paved road to the Big Canyon Mine to catch the Hercules Diesel-motored truck that United Motor Transport of North Sacramento purchased last May to haul the gold concentrates from this mine to the dock at the Port of Stockton, a distance of 90-odd miles each way. I had seen this truck at its home shop for service one night and again at Stockton the next morning, but wanted to see it getting a load of this $120-per-ton black ground rock they called concentrate. Luckily, we found it right in the midst of taking on a load, parked under the chute as the heavy material dropped down into the body of the truck. A load is approximately 20 tons, and the first five miles from the mine is steep uphill going with plenty of turns.

This truck is probably the most talked-about transportation unit on the Coast at the present time, we found, as I had been hearing about it for months in the San Francisco Bay district; and the nearer one got to it and its job, the stronger the story of its achievements. According to one of the owners, Mr. Schneider, this new Diesel-powered truck replaced four smaller gasoline trucks on this run; in fact, the contract could not be taken without figuring on the purchase and use of the Diesel, and there was great impatience until it arrived. The United Transport was losing money heavily on the contract until the arrival of the Diesel, which was hurriedly driven through from the factory, and an extra engine was ordered which was set on the floor of the service headquarters to insure schedules. That duplicate Hercules Diesel engine has never been taken out of its crate, however, nor has a wrench been laid on the working Diesel engine that has been getting in a mere 23 hours a day, seven days a week, since going on the job, at the time of the interview when 56,000 miles were recorded on the engine. Another 10,000 miles had been added when we saw it this Sunday morning at the mine, and It was going as satisfactorily as ever. Scarcely a sign of smoke showed, and then only at the start with the 20-ton load on a "cold" engine on a steep up-hill grade in low.

Next day we drove into Quincy from Marysville and Oroville, home of the big dredges whose endless chains of dippers have stirred the gravels of the Yuba and Feather Rivers for nearly a half century. An Allis-Chalmers oil tractor is used to move one dredge. Just outside of Quincy about five miles we found the Diesel-electric-powered Imperial mine with Superintendent Ernest V. Grant on the job assaying the quartz that was being brought up from a shaft that is to go down 200 feet. A 35-ton stamp mill, a new 6-cylinder Cummins Diesel engine on a Westinghouse generator, and an Ingersoll-Rand compressor gave the little outfit a trim, business-like appearance. A crew was at work getting out quartz. The Diesel engine pumps water for the job, supplying up to 50 gallons a minute and only burns 7 gallons of 6½ cent fuel oil per hour.

Here, the Diesel makes the job possible, being the cheap power link in an investment of $50,000 in new equipment, according to Vice-President Grant, who is well known in the engineering end of Hollywood productions. The company is organized under the name Mintdeoro Mines Ltd.

"Tommy" Robinson, Oakland Caterpillar Tractor dealer, has another dragline dredge mine powered with Diesels on dragline and screen in the Lincoln district. The Wyandotte Gold Dredging Company also uses a Diesel engine of 50 hp. rating. Vice-President R. M. Hoffman of Link-Belt Company's San Francisco branch, who has had considerable to do with installing and selling such equipment recently, tells the details in such a way that they are easily understood by the layman:

"The Dragline Dredge resembles its big sister somewhat in appearance, but is not a competitor, and in reality, does no digging. It is a compact and efficient washing and screening plant with sluices, riffles, stacker belt, and pumps. It involves a relatively small expenditure, and does an excellent job.

"The Dragline operation now being carried on by Wyandotte Gold Dredging Company, is a 'grizzly' for scalping out all boulders over gold recovery method.

"Briefly, the screening equipment consists of an open-end trunnion-driven cylindrical screen.

"The stacker belt conveyor, about 45-feet long, is supported by a steel truss; is equipped with Link-Belt anti-friction troughing idlers; and can be raised or lowered by a hand winch. The material is fed to the screen through a large steel hopper, which is usually fitted with a 'grizzly' for scalping out all boulders over 12-in. size, when working deposits where large boulders are frequent. Water sprays thoroughly soak the gravel in the hopper, before it reaches the screen.

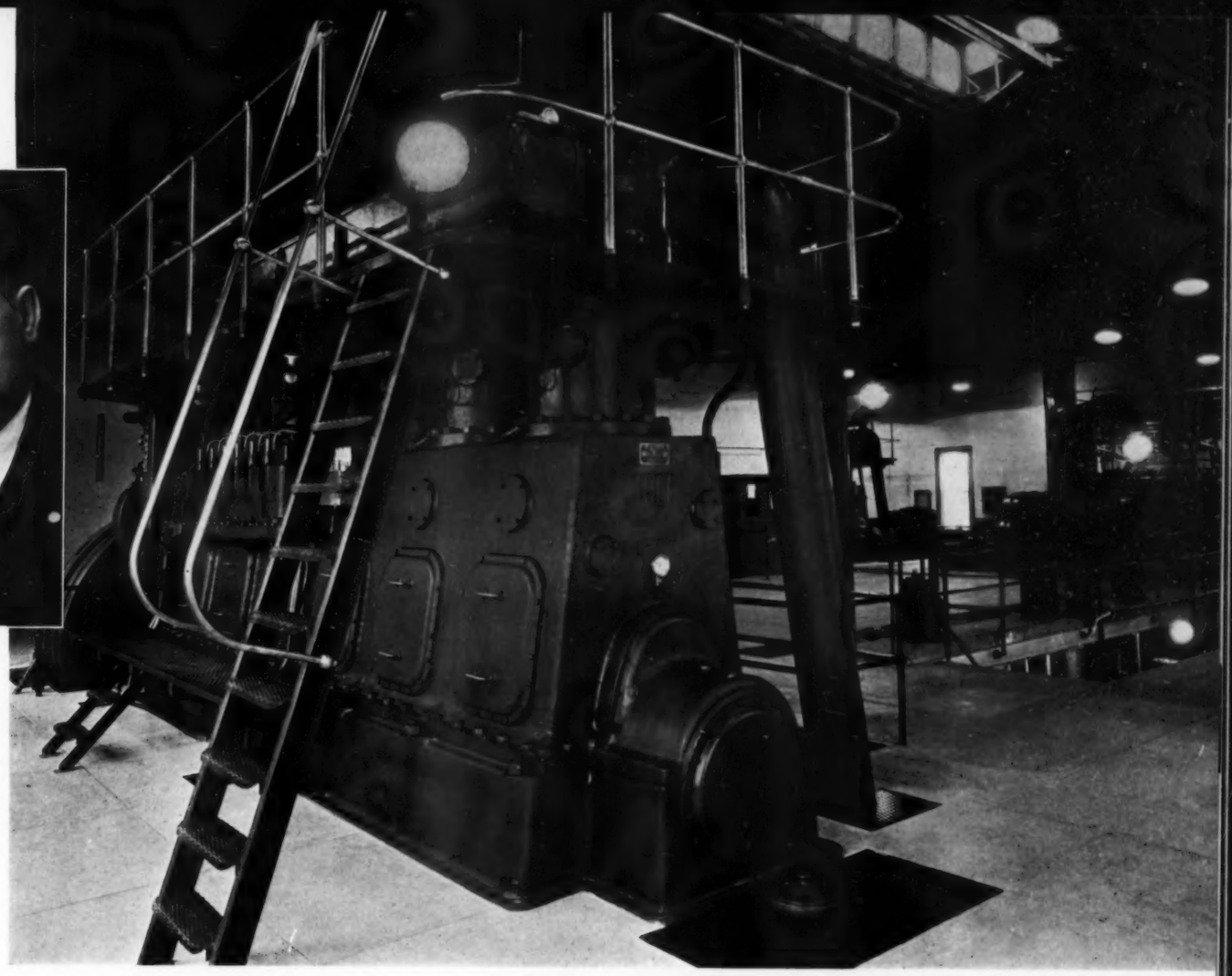
"The usual Hungarian riffles and quicksilver traps are employed, and the gold saving tables are set to slope to port and starboard from the center of the hull, which is also the axis of the screen. Sluices lead aft on each side of the hull, and overhang sufficiently to prevent wasted sands from fouling the boat.

"On the main deck is located a pump delivering about 2,000 gallons of water per minute to the screen spray pipe and to the sprays located at the hopper. A clean-up pump is located on deck, and is used for general washing down and at clean-up time, which is usually about once each week.

"On the upper deck, a 50 hp. Diesel engine furnishes the power. The engine is fitted with a clutch, and drives through a Meeseco short-center drive to a counter-shaft located just under the upper deck. From this counter-shaft, Link-Belt Silverlink enclosed roller chains drive the screen and the stacker, and another Meeseco short-center drive takes care of the pump.

"The timber hull measures 28 feet by 40 feet by 3 feet deep, and draws about 21 inches of water. As one old-timer in the hills put it, 'she can almost float up Market Street behind the water wagon.'

"Complete equipment includes fuel tanks and bilge pumps. There is no spud, as is used on the conventional dredge. Crossed lines and four winches control the boat in the pond."



NEW CASTLE, INDIANA

After 41 years' experience with steam for water pumping and electric lighting, the taxpayers of New Castle, Indiana, turn to Diesels for satisfactory and economical municipal power.

By NELSON HOWARD, *Chief Engineer*

IN these days of mounting taxes and governmental expenses, it is not good business to "carry coals to New Castle" (Ind.) or any other town where the citizens are really concerned with cutting costs of municipal power and electric rates.

This story is but one more case history in which an aggressive Mayor and City Council, honestly seeking cheaper dependable power, found the solution in the installation of modern, economical Diesel engines. And this step followed 36 years of experience with municipal steam plant operation plus five years of Public Utility supply.

The history of New Castle's problem of power and light from a chronological standpoint tells the complete story as it applies to thousands of similar communities today.

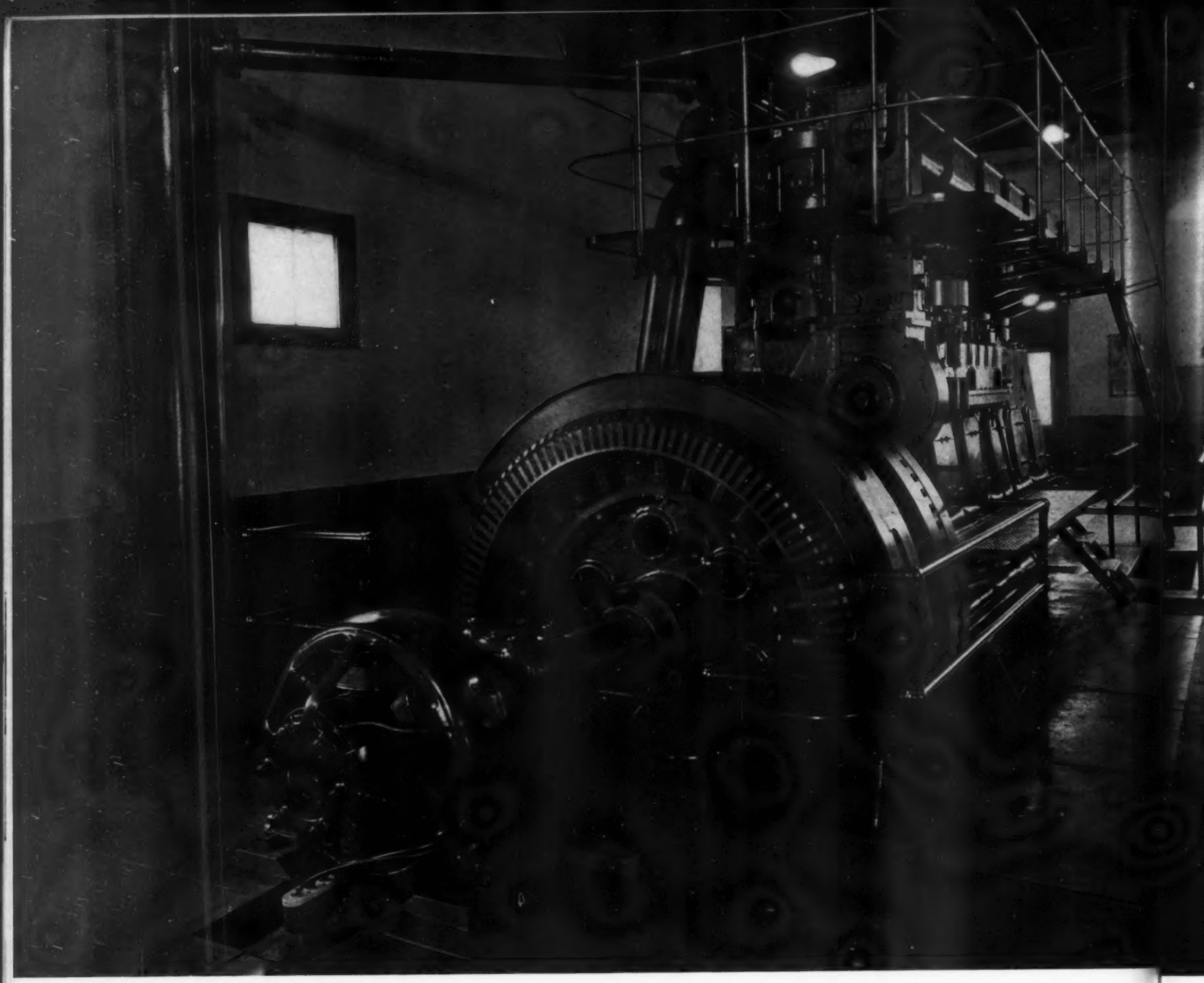
1891 – A small waterworks was built, consisting of two fire-tube boilers and two small duplex water pumps.

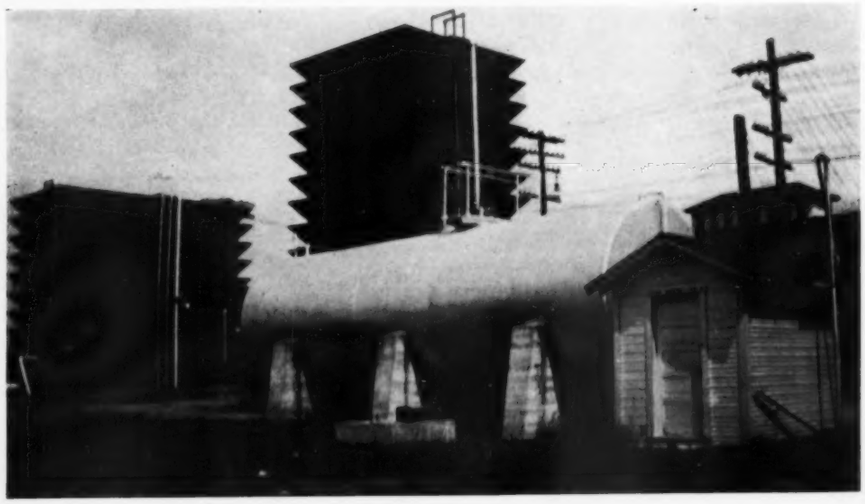
1892 – A second-hand Corliss steam engine was added and belted to two brush arc light generators for street lighting service.

1905 – Old water pumps were replaced by two McGowan duplex units of 2,000,000 gallons and 2,500,000 gallons capacity per day respectively.

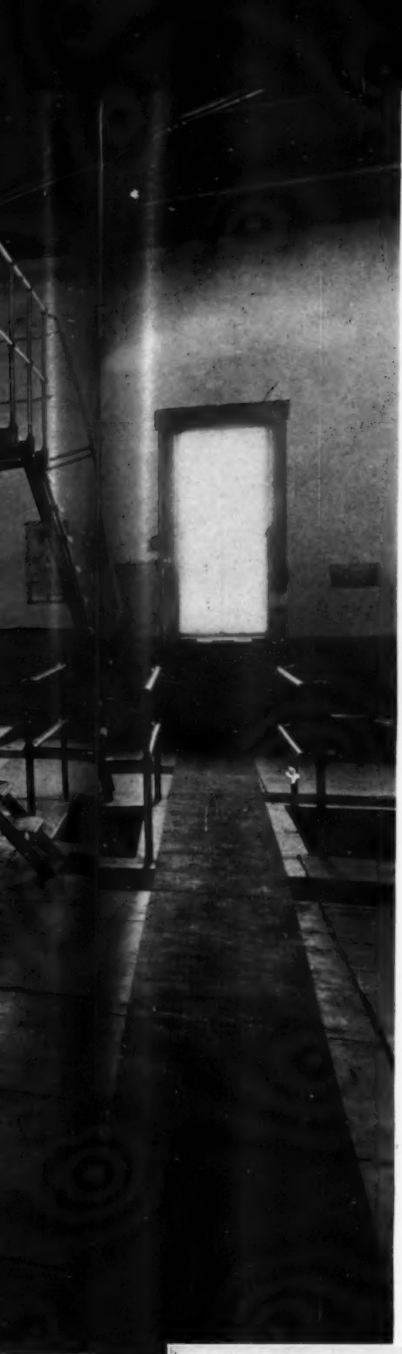
1907 – Fire-tube boilers replaced by two Heine water tube boilers of 225 hp. each.

1917 – Additional Heine boiler added of same size and type.





Above — The first De La Vergne Diesel installed in the New Castle Municipal Power Plant. To the right — The cooling towers and fuel storage tank and, on the opposite page, an exterior view of New Castle's profitable Diesel installation.



1921 — Old brush arc generators replaced by one a.c. generator of 250 kw., 3-phase, 60-cycle and 2,300 volts.

1925 — A new Allis-Chalmers cross compound Corliss pumping engine installed with a capacity of 4,000,000 gallons per day. The old pumps were retained for standby service.

1926 — A street lighting system of 309 post lamps was installed. This imposed a heavy load on the old steam engine and by now the boilers themselves were getting old.

1928 — After considerable discussion, it was decided to purchase electricity for street lighting and use the steam plant for pumping only. Hence, a five year contract with a public utility company.

It was soon discovered that this method was costing more than the former operation and the ensuing dissatisfaction resulted in the election of Mayor Sidney E. Baker and other officials in 1929.

1930 — (January 1) Mayor Baker took office and instigated an investigation through Fred Taylor, local engineer, into power costs. Taylor's report recommended generating all municipal power with a Diesel and installing motor driven water pumps.

1932 — Two De La Vergne Diesels with generators, exciters, etc., were installed. One rated at 750 bhp. with 518 kw., 3-phase, 60-cycle, 2,400-volt generator and the other at 500 bhp. with a 345 kw. generator. Three Allis-Chalmers centrifugal pumps with 3,000,000 gallons per day capacity each were also purchased with three 150 hp. electric driving motors. In addition, three deep well pumps were furnished by the A. D. Cook Pump Company and driven by 20 hp. motors.

On December 10, 1932, the new plant was in full operation and showing a saving of approximately $32.00 per day. In the fall of 1933 the city entered the commercial and domestic field and now has some 600 electric consumers. This load grew so rapidly that another 6-cylinder, 750 hp. engine with a 500 kw. generator was installed last winter and started January 9, 1935. This new unit is a duplicate of the former large unit, except for a different type cooling tower, and the engine is equipped with a Woodward governor.

Since this is a typical instance of the Diesel solution to the municipal power problem which confronts countless communities throughout the United States, it is important to offer irrefutable evidence substantiating the wisdom of the initial Diesel investment. Accordingly, for the benefit of other taxpayers and city officials who are seeking an honest and material reduction in power costs, the following actual figures are presented both for the operation of the new Diesel plant and on the basis of contemporary rates in effect with the public utility of the district.

. . . . *And now please turn to page 49*

"HARWELL"

Recent Addition to the Diesel Pleasure Fleet in Southern Waters this Season.

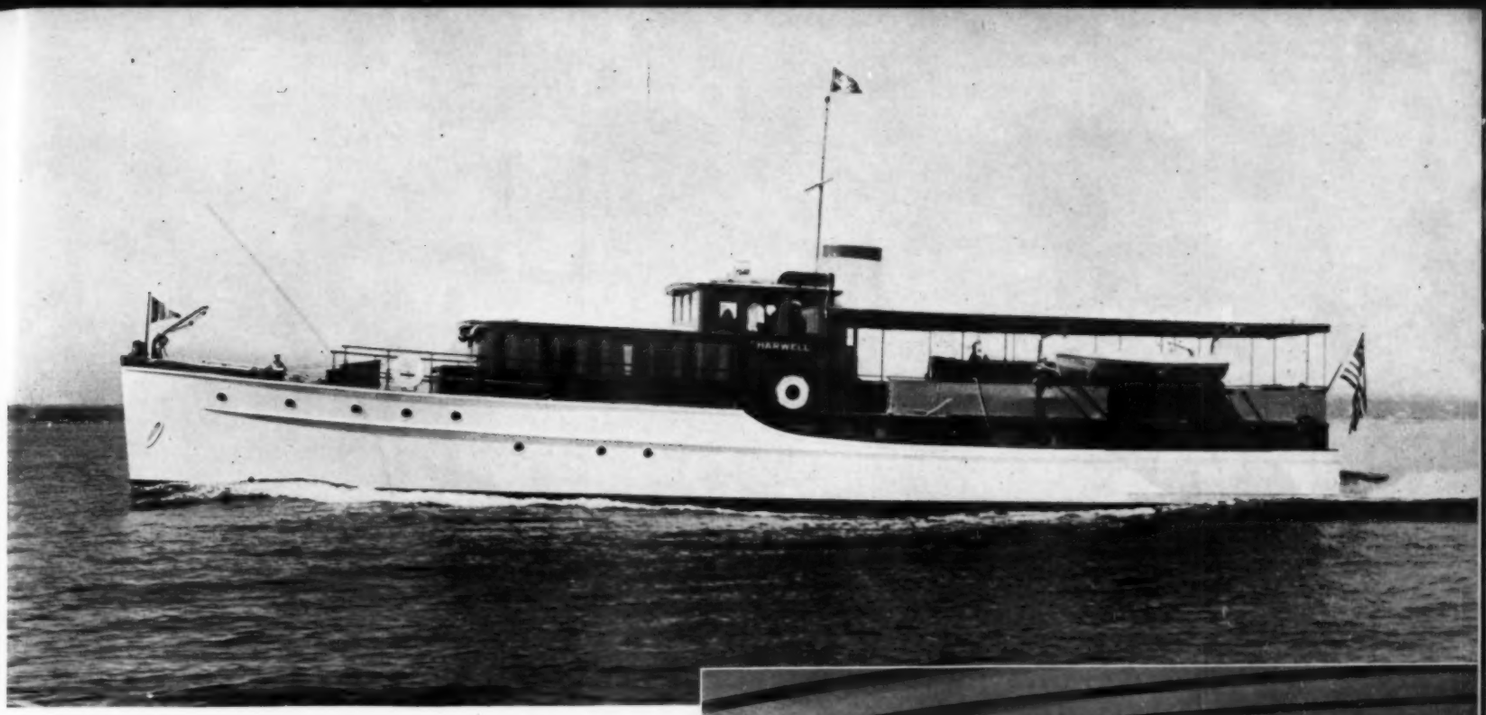
LAUNCHED this year by the Chance Marine Construction Company of Annapolis, the *Harwell* is one more splendid example of the application of modern marine Diesels to the small and medium sized pleasure craft.

This 80-foot yacht, built for Mr. Atherton W. Hobler, who is an ardent sport fisherman, makes the Stamford Yacht Club Harbor her home port but drops anchor quite frequently off the Montauk Yacht Club where her owner is also a member.

With a beam of 15 feet, 8 inches, she is amply spacious in all accommodations and two 6-cylinder Buda Diesels with 2.44 to 1 reduction gear drive fit into her hull very nicely with plenty of room to spare. Rated at 152 hp. each at 1,500 rpm., these light-weight, high-speed units provide the *Harwell* with a cruising speed of 16-17 mph. with no noticeable vibration or noise.

Above — Bow on view of Diesel yacht "Harwell" under way.

Right — Her trim and cheerful dining saloon.



As a result of such rapid strides by Diesel engine manufacturers during the past few years in developing more simplified designs, standardized production and dependable, fool-proof engines, it is not to be wondered that more and more of the progressive yachtsmen are turning to the safety and economy of this type of marine power when building new vessels.

So far as the sizes of the 1936 marine Diesels are concerned, they are practically the same if not smaller in some cases than an equivalent gasoline engine. Hence, it is no longer necessary for the owner to "re-build" his present yacht in order to convert her to Diesel.

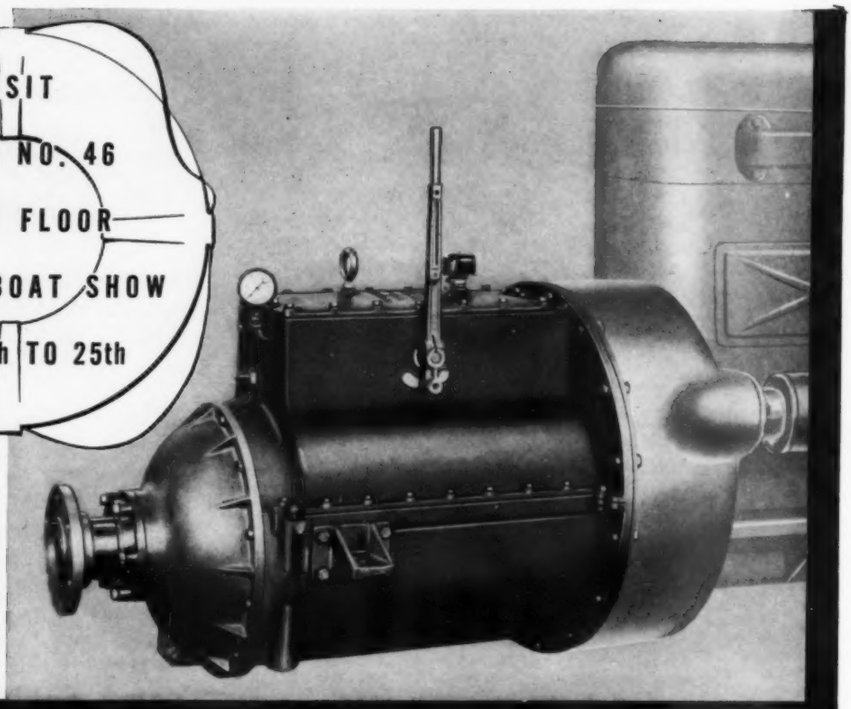
Due to the elimination of many unsightly protuberances which graced many of the old style engines, and the stream line covering of other necessary accessories, the marine Diesel engine of today is not only compact but beautifully clean cut in appearance so that even the engine room can now assume the graceful lines of the sleek exterior hull.

Every owner or prospective buyer, no matter how small a yacht he may have in mind, should investigate the many improved Diesels on display at this year's Motor Boat Show. There is no better investment from an operating economy standpoint and certainly no better guarantee against "sudden death" from bilge explosions.

Above — One of the "Harwell's" tastefully decorated staterooms.

Left — The galley is not only completely equipped but exceedingly well lighted and ventilated as well.

VISIT
SPACE NO. 46
THIRD FLOOR
AT THE BOAT SHOW
JAN. 17th TO 25th



TWIN DISC
MARINE REVERSE AND
REDUCTION GEAR
UNIT, MODEL MG-160

THE ONLY

MARINE REVERSE AND REDUCTION GEAR

applicable to any commercial engine

Here's what boat builders and engine makers have wanted for years. Easily assembled to any standard gasoline or Diesel engine . . . the Twin Disc Reverse and Reduction Gear Unit makes that engine adaptable for marine service. And it not only weighs less but costs less than conventional conversion units because all special oil pans, etc., have been eliminated.

Recognizing that a reverse gear is only as good as its clutches, Twin Disc engineers, with their background of 18 years extensive experience, selected close-coupled, multiple disc clutches operating in oil. Their use permits instantaneous shifting from forward to reverse. And, since gears may be operated in either forward or reverse direction of rotation *continuously*, two standard right hand rotation engines may now be used for twin screw installations. Model MG-160 is rated 160 hp. at 1200 rpm. *Write* for bulletin.

TWIN DISC
CLUTCHES

TWIN DISC CLUTCH COMPANY
1345 Racine St. • Racine, Wisconsin

NEODASHA
KANSAS

Erie crankshafts were selected for the two 550 h.p. Diesel Engines built by Nordberg Manufacturing Company for this municipal plant in 1922. In 1934 when additional power was required a new 1000 h.p. Nordberg Diesel, with an Erie crankshaft, was installed in this same municipal plant.

CRANKSHAFTS

Leading engine builders rely upon our experience and complete facilities for the manufacture of crankshafts and other forged parts, finished to the most exacting tolerances necessary for the smooth performance of their engines.

ERIE FORGE CO.

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WE ALSO MAKE..

Rough and finished connecting rods, piston rods, crossheads, generator and extension shafts for all classes of stationary and marine engines. Complete facilities for prompt delivery on all major forged or cast steel elements required in the building and powering of every type of installation.

Announcing

THE *Superior* DIESEL

8

A MODERN high speed, light weight, 150 horsepower, 1800 R. P. M. straight eight marine diesel engine will be shown for the first time in The National-Superior Company's exhibit—Block "L"—Grand Central Palace.

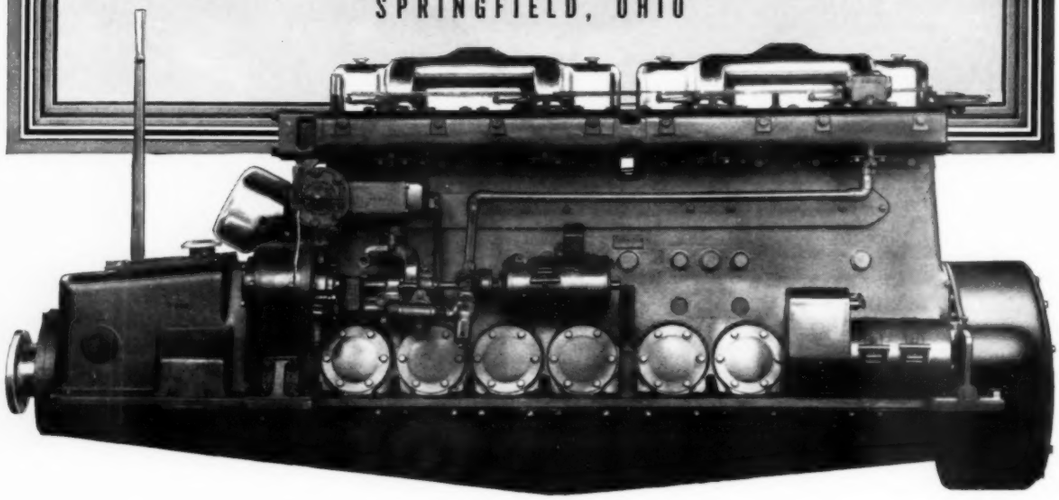
This rugged, compact engine offers the outstanding performance characteristics of the Superior Diesel to the owner of larger and faster boats.

Superior Marine Diesels and Electric Generating Units are now available in sizes from 20 to 150 horsepower.

4½-inch Bore
5¾-inch Stroke
150 Horsepower
1800 R. P. M.

THE NATIONAL-SUPERIOR COMPANY

SPRINGFIELD, OHIO



★ THE SUPERIOR MODEL MA-8 MARINE DIESEL ★

Simplified Starting Feature of International Harvester Diesel Is Engineering Achievement

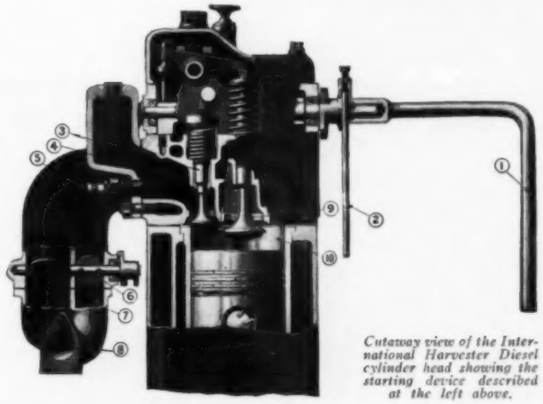
THE International Harvester Diesel 40 engine offers the exclusive advantage of starting as a gasoline engine and converting itself automatically to Diesel operation. This starting arrangement does away with the usual costly and cumbersome devices for starting, such as auxiliary engines, pumps, electric starters with heavy-duty batteries, etc. It enables the operator to crank the engine as readily as a conventional gasoline engine of corresponding size.

Setting a single control (1) (below at the right) engages the starting mechanism. This opens a valve (3) in the cylinder head, adding an auxiliary combustion chamber (4) for each cylinder, which reduces the compression pressure. A high-tension magneto is automatically engaged and furnishes a reliable spark to the plugs (5) mounted in the auxiliary chambers. The control also opens the butterfly valve (6) connecting the gasoline carburetor. This changes the engine to gasoline operation, ready for starting as a conventional gasoline engine.

When the engine has made a predetermined number of revolutions it shifts automatically to Diesel operation. The auxiliary valves (3) close, isolating the auxiliary combustion chambers and spark plugs, restoring the Diesel compression pressure. The magneto and carburetor are automatically disengaged. The Diesel fuel injection system starts to function and the engine continues to operate with an uninterrupted flow of power.

Below: The International Harvester Diesel TracTracTor. The Diesel 40 engine is also available in a wheel-type tractor—the International Harvester WD-40.

This simple operation changes the International Harvester Diesel into a conventional gasoline engine for starting.



Cutaway view of the International Harvester Diesel cylinder head showing the starting device described at the left above.

INTERNATIONAL HARVESTER TD-40 TRACTRACTOR
Here is a crawler tractor that offers the utmost in Diesel performance and economy. It operates on low-priced fuel without magneto, spark plugs, or carburetor, yet it starts under all weather conditions as easily as a gasoline tractor of equal capacity. Combined with the unique feature of easy starting are the outstanding features of unit construction and accessibility. The International Harvester TracTracTor is the most accessible crawler tractor built. Complete information will be forwarded on request.

INTERNATIONAL HARVESTER COMPANY
(*Incorporated*)
606 So. Michigan Ave. Chicago, Illinois

INTERNATIONAL HARVESTER

CHICAGO PNEUMATIC PLANT

. . . . *Continued from page 30* . . . .

drop to a set point, the pumps operate and fill the tanks to a higher level where they then cut out. Auxiliary pumps located on the Diesels pump the oil to the Diesel as required. The lubricating oil is handled and purified by a De Laval separator, although as an auxiliary unit the plant has a steam filtrator which is used during the winter months when a steam supply is available.

The cost of the cooling water for the cylinder jackets is kept to a minimum by a reprocessing arrangement with the aid of a natural supply nearby, as French Creek flows adjacent to the plant (Fig. 2). The water from this creek is soft and aside from being filtered requires no other treatment. From the creek it is automatically pumped by a 1,000 gal. min. centrifugal pump to a 300 bbl. tank located on top of the boiler room where it then drains by gravity through the Diesel units. The exhaust water then passes through a heat exchanger and is used as a boiler feed water in the boiler room. As the temperature of the water leaving the Diesel units is around 90 deg. F., the exhaust gases from the Diesels pass around the heat exchanger and raise the temperature of the water from 90 deg. F. to 130 deg. F. Thus the heat exchanger acts also as a silencer on all the units and proves very effective, the back pressure being approximately 4 oz. Air intake cleaners are provided for all intake air.

Each cylinder of each Diesel has its own thermometer, pyrometer, and indicator connections, so that the individual performance of each cylinder may at any time be checked for equalization of the load.

A 9-3-¾ x 6 Chicago Pneumatic, two-stage, vertical, motor driven compressor supplies starting air (Fig. 3). It is automatically controlled. This unit has a piston displacement of 155 C.F.M. and can be operated to a maximum pressure of 500 pounds per square inch. The air is stored in two receivers and starting air is always available.

The generators are all Burke, 3-wire dc. compound wound units having their respective recording instruments mounted on a central Westinghouse switchboard. The load upon any one of the units can be read instantly by glancing at the recording kilowatt hour meters, one for each unit, and the entire output can be read on a master meter on the switchboard.

Located in the power plant is also a 3-cylinder, 225 hp. Diesel directly connected to a C.P. 20-12 x 14 two-stage compressor (Fig. 4). This unit was first installed as a gas engine in September, 1929, but due to high cost of gas it was changed in April of 1930 to a Diesel unit. This unit supplies air for all air-operated tools throughout the plant.

The conversion feature of the C.P. Diesel is a very outstanding one. By the addition of a very few parts the gas engine can be converted to a Diesel engine at any time. Thus if the gas rates in certain localities become too high, or the fuel rates too high, a quick changeover to a Diesel or vice versa can be made.

The plant also contains a horizontal, two-stage, steam driven compressor which operates only in winter because then the steam exhaust can be used for heating purposes.

The Chicago Pneumatic Plant operating 24 hours per day is a real Diesel installation. As one walks into the power plant, no array of fuel tanks or pumps greets his eyes, as these are all located in a basement underneath. The massive engines having a combined output of 1,300 hp. just seem to be running like clocks and since the load has increased daily with increased operations, another 450 hp. Diesel is being installed.

Although the primary purpose of this plant has been to generate electrical current, it has also served well as an experimental Diesel laboratory. Various tests have been run during the past seven years in order to prove certain Diesel theories and practices. For instance, many fuel consumption tests have been made; injection pumps and nozzles have been constantly in operation for months in order to examine their condition and establish definite cleaning periods; numerous lubricating oil tests have been performed; and various parts have been tested for strength and wear under operating conditions.

Since this plant was put into operation daily records of each Diesel unit have been kept which show that Diesel power is the ideal method of generating current. During the month of August, 1935, the output of the plant was 136,620 kw. hours. The costs during this month per kw. hour with the unfavorable load factor of 43.3% were as follows:

	Cents
Fuel	0.5970
Lubricating Oil	0.625
Repair Parts	0.000
Attendants	0.1760
Total	0.8355 cents per kw. hr.

No attempts have been made to see how low a cost per hour could be secured as the above figures show, but they do indicate that in a Diesel installation where economy of operation is of prime importance a cost well under 1 cent per kw. hr. can easily be obtained.

To substantiate the above figures it is of interest to note that the Christmas Copper Company, Christmas, Arizona, have four Diesels of the same design and rated at 450 hp. each which after operating one full year showed a cost per kw. hr. of 0.84 cents.

We Supply TRAINED DIESEL ENGINEERS

From New York, Chicago, Detroit
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Former Diesel, steam and gas engineers, machinists, shovel and caterpillar operators, sales engineers. These properly trained Diesel men will make valuable Diesel operators, maintenance men and salesmen for you. Many firms look to us for their Diesel help. Write, wire or phone our nearest school.

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1520A McGee Street, Kansas City, Mo.
3320B 20th Street, San Francisco, Calif.

NEW CASTLE, INDIANA

. . . . *Continued from page 41* . . . .

There can be little doubt that the citizens of New Castle are satisfied with their Diesels, since Mayor Baker and most of his city administrators were returned to office at the next election.

RESIDENTIAL RATES

	Public Service Co.	*Municipal Diesel Plant*
First 30 kwhr.	6½c per kwhr.	5½c per kwhr.
Second 30 kwhr.	4½c per kwhr.	4c per kwhr.
60-100 kwhr.	2½c per kwhr.	2¼c per kwhr.
Over 100 kwhr.	2½c per kwhr.	2c per kwhr.

RETAIL POWER RATES

	Public Service Co.	*Municipal Diesel Plant*
First 100 kwhr.	4½c per kwhr.	3½c per kwhr.
Next 300 kwhr.	3½c per kwhr.	2¾c per kwhr.
Next 600 kwhr.	3c per kwhr.	2¼c per kwhr.
Over 1000 kwhr.	2¼c per kwhr.	2c per kwhr.

REPORT FOR LAST SIX MONTHS OF 1934
July 1, 1934, to January 1, 1935

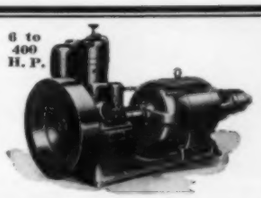
Generated, kwhr.	1,249,400
Load factor	33%
Fuel oil @ 5.2c – 109,702 gal.	$5,704.50
Lube oil – 552.6 gal.	$207.71
Engine repairs	$86.21
Labor	*$1,903.50
Supplies	$193.01
Supervision	$475.00
Depreciation	$1,050.00
Total operating cost	$9,619.93
Cost per kwhr., @ switchboard	.769c
Kwhr., per gal., fuel oil	11.38
Kwhr., per gal., lube oil	2,346

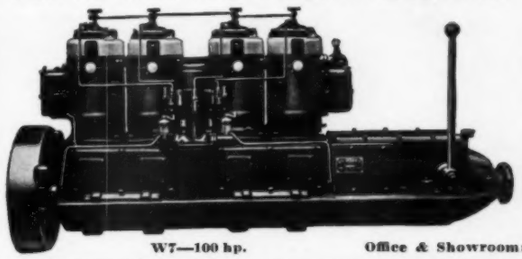
*Labor cost is low because a combined waterworks and power plant is operated and only half the labor cost is charged to the Diesel power plant.

A careful analysis of the individual items having a common basis of comparison will show that the savings run from a minimum of 11% to a maximum of 25%. The average of these economies is 18.1% which, at the end of a community's fiscal year, will represent a very substantial and gratifying picture in dollars and cents to the individual consumers. With all the divers power rate reductions under advisement by utilities and commissions in various sections of the country there has been to date no such drastic cuts proposed. Nor is it reasonable to expect such good fortune due to the existing fundamental differences between public utility power generation and distribution for profit and privately owned Diesel municipal power service.

It certainly seems, therefore, that the above comparisons should stand as shining examples of what the Diesel engine manufacturers have been contending for some years, namely: that there are very real and substantial economies in Diesel power plants.

BOLINDERS
DIESEL ENGINES
FOR MARINE AND INDUSTRIAL SERVICE





W7—100 hp.

BOLINDERS Diesel Engines are known throughout the world for their ruggedness, economy and trouble-free performance. From 6 to 400 hp., there is a size and type for every kind of service either for main power purposes or for auxiliary service. Write today for specific information on an engine to fit your problem. Please mention your requirements in your inquiry.

BOLINDERS COMPANY, Inc.

Office & Showroom: 35 Rector St., New York, N. Y.

FABRIFORM
ELECTREFINER

Converts Waste Into Profit
Successfully Re-Refining Used Diesel
Lube Oils and General Crankcase Drainings

FABRIFORM Electrefiners are now producing high grade lubricating oil from Diesel and general crankcase drainings, used red engine oil, and turbine oil at costs of less than 6c per gallon. Electrefiner does not merely filter or reclaim used lubricants; it actually re-refines, restores color, and produces an oil as good or better than new, at a rate of over 5 gallons per hour.

No moving parts — 90% automatic in operation—electrically operated—thermostatically controlled. A Fabriform Electrefiner will quickly save its initial cost by decreasing lubricating oil bills approximately 66%.

Write for descriptive literature and complete information, with details of N.H.A. time payment plan. We also invite inquiries from responsible sales organizations relative to territories now open.

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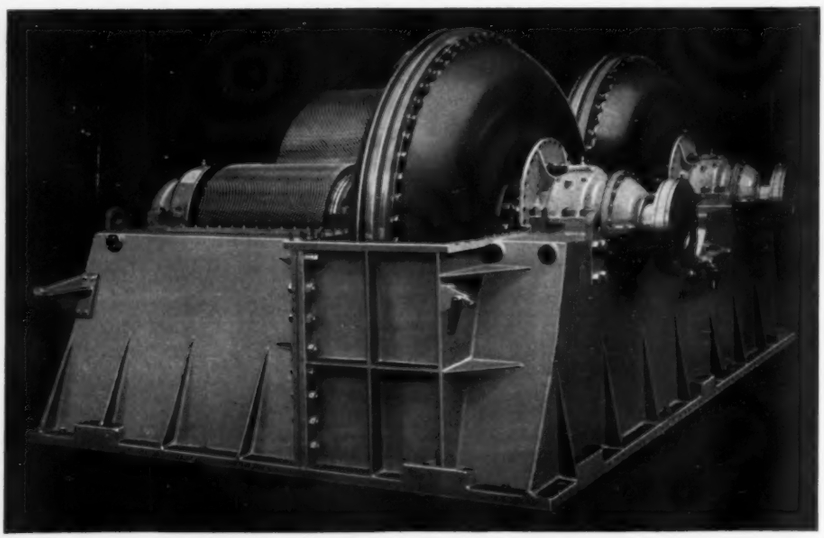


HIGH SPEED DIESEL DRIVES SLOW SPEED PROPELLER

The Hydraulic Coupling makes possible the direct connection of a slow speed propeller to a high speed Diesel engine through mechanical reduction gears without the transmission of torsional vibrations or shocks. It also permits rapid clutching and declutching. For data write to

HYDRAULIC COUPLING CORPORATION

632 FISHER BLDG., DETROIT • 40 WEST 40TH ST., NEW YORK CITY

Division of American Blower Corporation

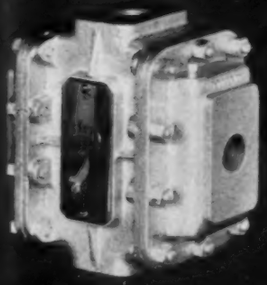
HARRISON

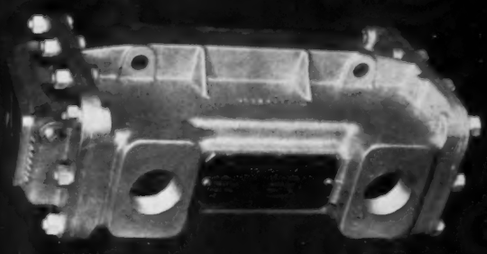
HARRISON

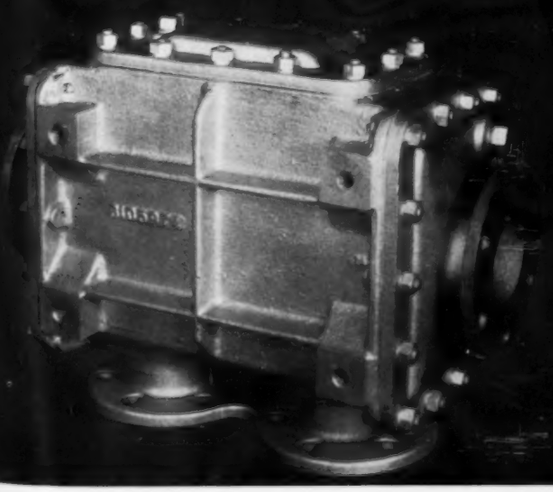
HEAT EXCHANGERS
. . . for Diesel Engines

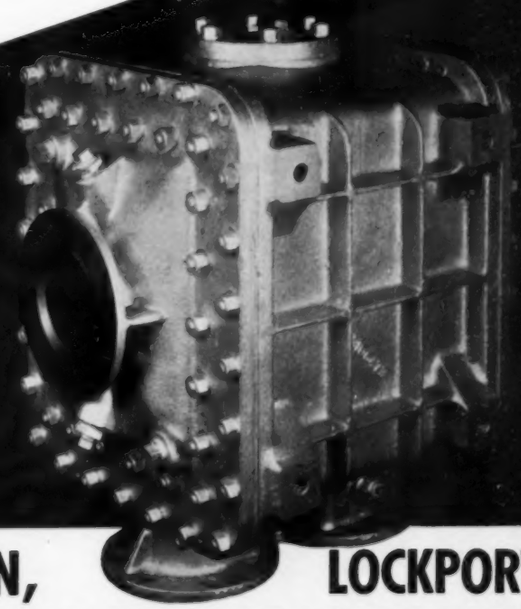
★

Harrison offers a line of Heat Exchangers particularly suitable for Diesel engine cooling. Each unit is compact in design, and efficiently cools either water or oil, in large or small installations. Single units are now cooling engines from 50 h.p. to 1400 h.p. The Harrison Heat Exchanger provides uniform jacket water and engine oil temperature control, thereby improving the operation and contributing to the economy of any Diesel engine on which it is installed. Specify Harrison Heat Exchangers for water and oil temperature control, and call upon Harrison's engineering and manufacturing departments at any time. Their experience, gained through years of service in the heat transfer field, is available to you.









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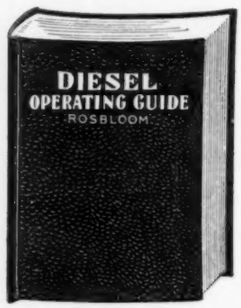

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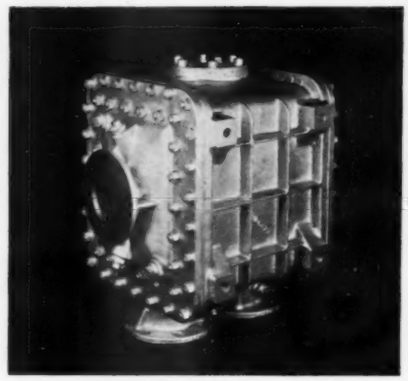

OIL COOLING

OIL cooling has become a real problem in the Diesel Industry during the past year or two, as engine speeds have climbed, engine weights gone down and the necessity created for oil coolers not only more efficient but more compact.

The Harrison Radiator Corp., with its splendid background of experience in heat exchanger problems in the automotive industry, came into the Diesel Field some two years ago and, within that short period, has developed a comprehensive line of heat exchangers for both oil and water cooling. The illustration shows one of their model 16 units and is typical of their liquid-to-liquid cooling type. Coolers of this type have a wide variety of applications of heat exchange in the industrial and marine field. Many are in use in regulating the temperature of the lubricating oil on Diesel engines. For marine service, all parts coming in contact with the cooling water are constructed of non-corrosive materials and as a consequence several applications of this unit have been made in connection with closed systems of cooling on yachts and work boats.

Those of our readers who are around New York City from Jan. 17 to Jan. 25, may have the opportunity of seeing these Harrison heat exchangers at the Motor Boat Show.

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Many operators have found Gargoyle D.T.E. Oils the most Economical Diesel Lubricants in the World

THOUSANDS OF DIESEL OPERATORS, who have used other oils, declare that Gargoyle D. T. E. Oils save them the cost of ring replacements. What you save on rings may pay for these superior lubricants. And you may find fuel consumption measurably reduced.

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Engineered to their varied uses . . .

Above . . . Exhaust Manifold for giant Diesel railroad engine. Right . . . Combination Intake Silencer and Air Cleaner for use on smaller industrial units.

BURGESS ACOUSTIC

MUFFLERS, SILENCERS AND AIR CLEANERS

The wide range of sizes and various types of installations into which the modern Diesel engine is finding its way present a great array of silencing and air-cleaning problems. Burgess-Acoustic engineers have found the answers to these varying requirements. Employing the Burgess straight-thru principle, they have developed a series of exhaust mufflers and manifolds and intake silencers and air cleaners that fulfill the requirements of small and giant engines and of automotive, rail, marine and industrial applications. This equipment has proven its efficiency and economy to the satisfaction of the industry's leading designers, engineers and operators.

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MADISON, WISCONSIN **DETROIT OFFICE, NEW CENTER BLDG.**

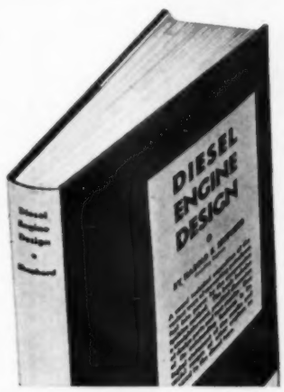
UNION PACIFIC CLARIFIES

THERE has been a certain amount of misunderstanding about the number of Diesel trains in use and on order by the Union Pacific. Mr. E. C. Schmidt, their director of News Service, clarifies as follows:

Number One, known as the *M-10,000,* is operating between Kansas City and Salina, Kansas. Number Two, the *City of Portland,* is on the Chicago-Portland run. Number Three, the *City of Los Angeles,* will operate between Chicago and Los Angeles. Number Four, called the *City of San Francisco,* will operate between Chicago and San Francisco. Both three and four are expected to be in service on or about April 15th. Numbers Five and Six will be called the *City of Denver* and will leave Chicago and Denver respectively every day. Expect to start service early in January.

MORE MOTORSHIPS

ACCORDING to *The British Motor Ship* the tonnage of mercantile vessels ordered from British yards by British owners during October and November, 1935, was 323,000 tons, and of these ships 60 per cent will be equipped with oil engines.



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Consulting Engineer,
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"DIESEL ENGINE DESIGN" will be indispensable to the engineer who needs a sound technical exposition of the various ways of converting petroleum fuel into power by the compression ignition method. The author, H. F. Shepherd, is an authority on the design and operation of Diesel engines. He has for many years been active in their development, and is the inventor of numerous special features and improvements well known to engineers in this field.

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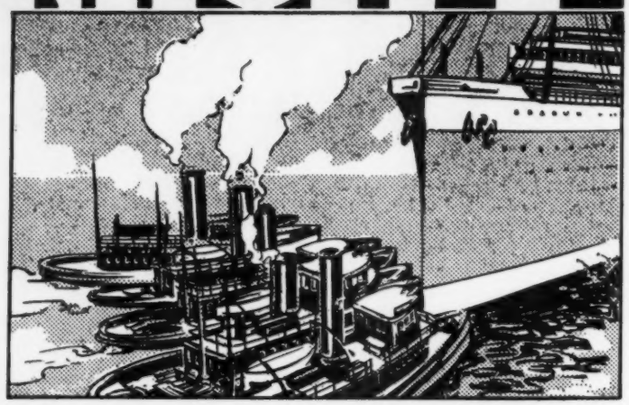

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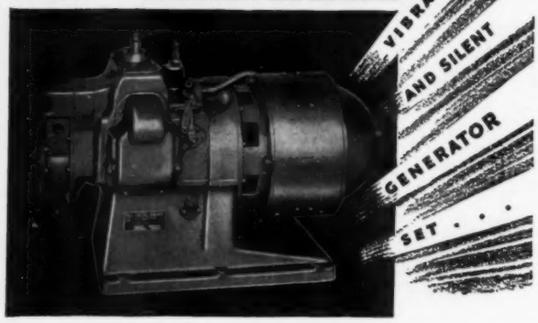

BALANCE—an entirely new development in Diesel construction, brings complete freedom from vibration; extreme simplification; and remarkable reduction in size and weight.

Opposed pistons in a horizontal cylinder transmit power to the crankshaft through a very simple mechanism. All parts are balanced, all masses move in opposite directions at the same speed always. A perfected combination of Bosch injection pump, Hill precombustion chamber and Hill single orifice nozzle assures instant starting without preheating and insures dependable operation.

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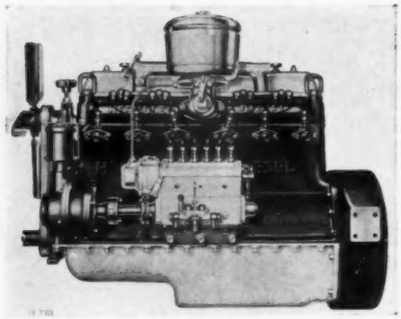


SMALL DIESELS

THE insistent demand for smaller and smaller Diesels has brought forth an answer from Hercules Motors Corporation in the form of an announcement on their model DJX series.

Both models in this series are six-cylinder, the smallest having a 3½″ bore and 4½″ stroke – 260 cu. in. displacement. The other unit has a bore of 3 11/16″ and 4½″ stroke – 288 cu. in. displacement.

The 3½″ bore engine is rated at 79 hp. and the 3 11/16″ job at 82.5 hp. both at 2,600 rpm.

This DJX series of new Diesels are interchangeable from an installation standpoint with the extensively used Hercules JX series of gasoline engines – thus permitting manufacturers to supply either gasoline or Diesel engines in their equipment without mounting complications.

The rapid advance in the application of Diesel engines to tractors, shovels, cranes, trucks, buses, etc., has been made possible by strides engine manufacturers have made in recent years in designing and building efficient, dependable Diesel engines compact enough and light enough to replace gasoline engines previously used in this type of mobile equipment.

The Hercules Motors Corporation is to be congratulated on their success in developing a complete line of high speed Diesels, ALL of them interchangeable with their gasoline engines of approximate rating.

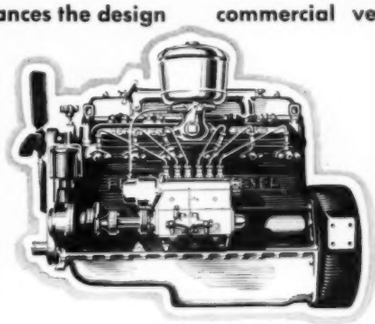
The Hercules Diesel line now consists of a 5″ x 6″ series, a 4⅜″ x 5¼″ series and now the small units illustrated and briefly described above.

The addition of this line of small Diesels opens up the application of Diesel engines to small trucks, buses and tractors, and we expect to be able to illustrate and describe several such applications in early issues of DIESEL PROGRESS.

HERCULES

DIESEL ENGINES

LEADERSHIP—With the advent of the small, 6-cylinder Hercules Diesels, the United States further advances the design and production of high-speed, heavy-duty Diesel engines. These small Hercules Diesels—Series DJX—develop 79 H. P. and 82.5 H. P. respectively at 2600 R. P. M. They make possible the advantages of compression ignition power for the first time in a wide additional range of uses, including small commercial vehicles heretofore limited to gasoline operation. All Hercules Diesels are characterized by unusually complete combustion—the result of a combustion system which is entirely an American development, designed and patented by Hercules.



HERCULES MOTORS CORPORATION, Canton, Ohio

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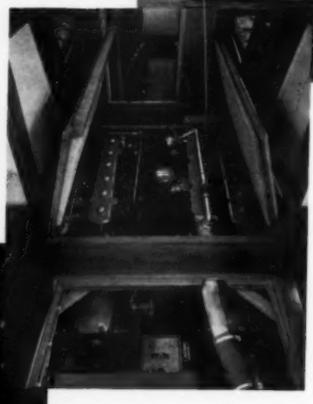
Elco Diesel for Hawaii. The "OIO," a Custom Cruisette 38 with Diesel power, built for Mr. John Waterhouse of Honolulu. The "OIO" is Mr. Waterhouse's third Elco, and was ordered with this type of engine for cruising and fishing among the Hawaiian Islands. Powered with two 6-cylinder Buda Diesels, Type 468, 85-100 hp.—installed with Elco patented rubber mounting and Elco sound-proofing. This beautiful Diesel-equipped twin screw Cruisette has a cruising range of 1,000 miles.

Elco
CRUISERS

America's Leading Cruisers now offered with Diesel Power

PURCHASERS of Elco Cruisers can now enjoy all the benefits of Diesel Power in their boats—the greater economy (fuel cost less than 3c a mile), increased cruising range, and absence of fuel fire hazard. Elco has perfected the installation of Diesels for even small cruisers, thanks to the experience of the parent company, The Electric Boat Company (which built the first marine Diesel Engines for commercial and naval vessels), and to two years of practical testing. The major problems of vibration and noise have been completely solved by Elco's patented suspension-type rubber engine mounting and Elco's sound-proofing. All Elcos are now offered with either gasoline or Diesel motors. Write for Catalogue D and prices.

"No Vibration." The "Nogas" (below), a Diesel-powered Custom Cruisette 32, built for Mr. Garret A. Hobart for use on Rangley Lake, Maine. Equipped with 4-cylinder Buda Diesel, Type 186, 32-40 hp. Mr. Hobart states, "I am particularly pleased with the lack of vibration. This, with a 4-cylinder motor, is a real tribute to your type of Diesel installation."



A Diesel Fisherman. The "Florolina" (above), a Diesel-powered Custom Cruisette 38 with sport fishing gear, built for Mr. A. T. Heath for use off the coast of South Carolina and Florida. On her maiden voyage from Bayonne, N. J., to Murrels Inlet, South Carolina (a distance of 800 miles), the cost of fuel for the "Florolina" was $23.60—or less than 3c a mile. This hardy Diesel-equipped cruiser has now gone over 8,000 miles. **(At Left)** The "Florolina's" power installation—two 6-cylinder Buda Diesels, Type 415, 65-85 hp. Her fuel capacity is 300 gals.; her range 1,000 miles.

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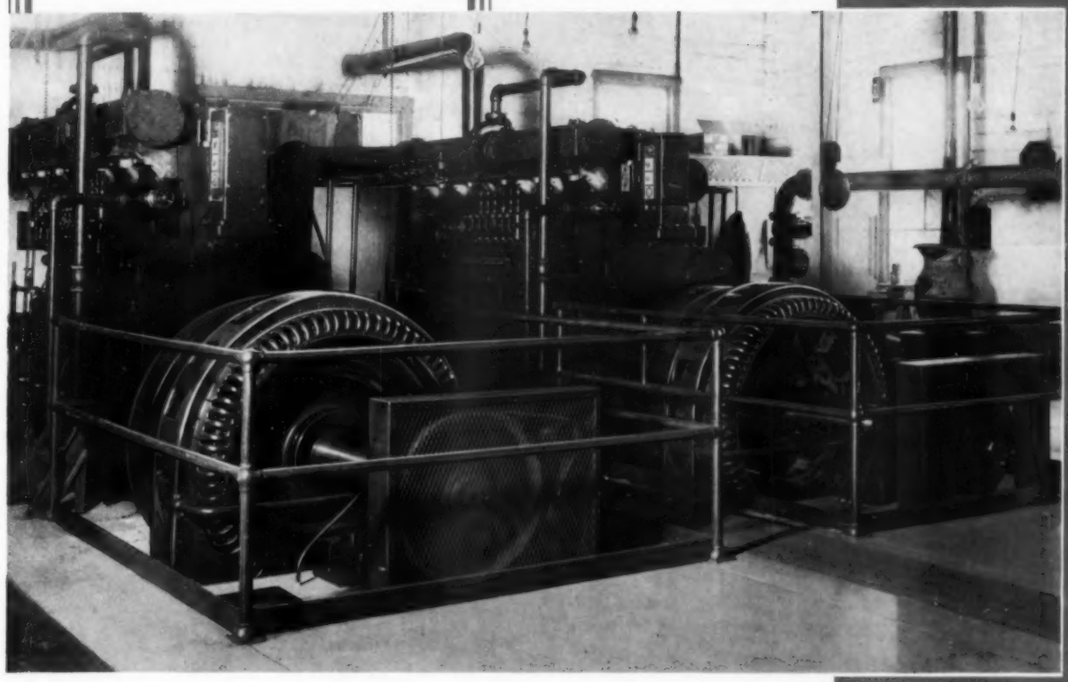

- Elliott generators have dependable and long satisfactory service built into their smallest parts. Engineered exactly to the particular Diesel it is to serve, every Elliott generator receives the careful study and concentrated attention of a specialized staff.

- Elliott generators use heavy, rugged, cast construction. Smooth, steady operation is a result. Heavily ribbed rotor spokes prevent vibration, torsional or lateral. Field coils are built to stay in place and never give trouble. Strong winding guards protect the end turns from mechanical injury. These are a few of many points of careful design and conservative construction.

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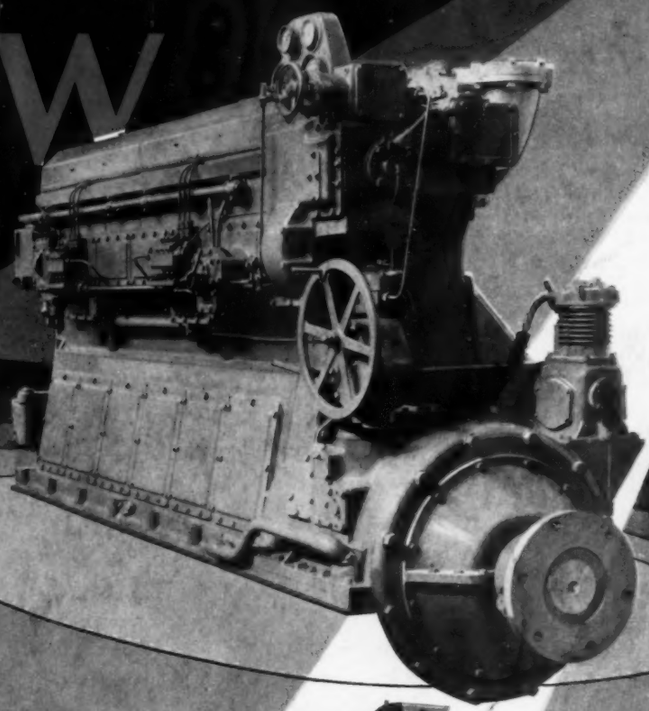

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THE Type-GN was designed especially for Diesel Electric Locomotives.

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